



EXPLORATION AND EXPLOITATION AT UNIVERSITIES

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ABSTRACT

This study analyzes the impact of resources and capabilities used by any organization on their competitiveness. Specially, it is based on the analysis of the concepts of exploration and exploitation in organizational learning. Using the field of universities, it examines whether the combination of exploration and exploitation activities in these organizations can have a positive impact on their competitiveness.

INTRODUCTION

Today, with a global market, and the existence of a large number of organizations, there is a need by these to compete with each other in order to maintain market share and competitiveness. In order to become stronger and competitive, organizations are focusing on gaining a competitive advantage to differentiate them from other competitors, and therefore be able to obtain more power. This level of competitiveness occurs with any organization oriented to obtain market share with the development of their business.

In recent years, numerous studies explain the role of resources and capabilities in organizations, in order to gain a competitive advantage.

But what is the main role of resources and capabilities in obtaining a competitive advantage? This paper aims to show the importance of the resources and capabilities of organizations in obtaining a competitive advantage.

Specially, the objective of this paper is analyze the importance and the effect that combination of exploration and exploitation activities produces on universities.

First of all, in the theoretical framework, this study explains the importance of resources and capabilities, and also the concepts of exploration, exploitation, and the combination of both activities (ambidextrous organizations). Finally, an explication showing the combination of exploration and exploitation activities at universities.

In the empirical part, this study analyzes three Spanish universities to show the effect that produces the combination of exploration and exploitation activities on universities. With this empirical part, it analyses if the universities with better combinations of exploration and exploitation activities, are the ones with better competitive positions.

Using a general ranking of Spanish universities, we analyze three universities to observe the efforts and practices of exploration and exploitation activities, to compare the results and demonstrate if the differences observed between these universities are in the particular use and combination of both tasks (exploration and exploitation).

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1. THEORETICAL FRAMEWORK

1.1 The importance of resources and capabilities into the competitive advantage

The existence of a global market, and many companies, makes necessary competitiveness in business. The main objective of any organization is to obtain profits and be stronger, and therefore it needs a suitable market to develop his economic activity. Until the 1980s, most companies have characterized by having strategies focused on detecting the needs of consumers and provide technological capacity, necessary to develop their activities. In those moments, markets were not exploited as currently, enabling firms to have a suitable part of the market without the necessity to compete with others firms.

The 21st century business landscape, is characterized by the fact that companies must compete in a complex and challenging context mainly transformed by globalization, as well as frequent changes in technology applications (DeNisi, Hitt and Jackson, 2003). The existence of greater number of organizations in markets has caused stronger competitiveness. In recent years, has emerged the need by companies to differentiate itself from others competitors, to obtain a suitable part of the market share.

“Competitiveness is the relative position over the competition, as well as fitness or ability to hold you long term and improve it, if it's possible” (Bueno, E 1993). However, to be competitive nowadays, organizations need to have a competitive advantage that allows them to differentiate themselves from the rest of its main competitors *“Competitive advantage is the property of the Enterprise that isolates it from the direct company within its sector”* (Jarrillo J.C, 1990; Michael E, 1985).

Most of today's economic companies focus on search and get something different to other companies, allowing them to compete with these. *“A company has a competitive advantage when it implemented a strategy of value not used by any of its competitors, and also this strategy it's difficult to copy by these”* (Barney, 1991). It should be clear that nowadays the difference between companies with his competitors is the aspect that allows these companies to compete in the market.

Over the years, some authors have been publishing studies focused on the importance that have the resources and capabilities of the companies to as a way to obtain a competitive advantage. They explain how they are the assets and activities of any firm, the elements that differentiate this firm from the rest of the industry, allowing the company to be higher or lower in his business. A very important concept of these

studies is the “*Theory of the Resources and Capabilities*” (Parra y Calero, 2006). This theory considers that an organization can be different from other, by the resources and capabilities that this firm have at any given time, as well as the different features and the non-availability of these resources by other companies. This difference in resources and capabilities allows any firm to obtain a competitive advantage.

Resources, capabilities and the routines of any company have become the basis of most of the strategies followed by companies. Therefore, these elements allow companies to be different over its competitors, and thus allow these companies to obtain a competitive advantage. “*Across the value chain, firms can detect the potential of his resources and capabilities as a source of competitive advantage*” (Porter, 1995).

1.2 The role of innovation in business competitiveness

The economy has always considered labour and capital as the main factors linked with the economic growth. Nowadays, this situation has changed mainly due to the emergence of a new economy based on Knowledge “*The Knowledge based Economy*”.

This new economy raises the generation and exploitation of the knowledge, and associates it with the creation of well-being and economic development. Factors such knowledge and information have become more important elements than labour and capital. The enormous and quickly development of new information technologies and telecommunications, are responsible for the generation of this new economic framework.

The investment in Knowledge can increase the productivity of factors of production, as well as develop these factors in new products and processes (López J, 2004). Currently, new ways of working are being developed, based on innovative ideas where the risk, insecurity and constant changes are present on the day of the business.

Innovation has become something important for the companies and the current business framework. A higher part of the success of many businesses can be explained by its innovative strategies and character. These companies, through innovation, develop new ideas or products, new ways to manufacture it, distribute it, ... Also, this new ways of operate can support the difference of the company from the rest of his competitors, allowing it to obtain a competitive advantage.

Nowadays, with a high competitive market, innovation can be a very important element for a company to compete and obtain a suitable part of the share market. Innovation supports differentiation.

As the author Ruiz González said (1988), the innovation process can be understood as “The set of activities listed in a given period of time and place, producing the successful introduction on the market, of an idea, a new product or process, a service, an organization or new management techniques”

To carry out the process of innovation, it is necessary to develop different activities of an organization. Nowadays, most of the activities carried out by a company, participate in the process of innovation whether marketing, development, research, commercial activities... However, the activities of research and development (R+D), are the main in this process.

Research is the process of original and planned research that seeks to discover new knowledge and a high understanding of the elements. Development consists of the application of the knowledge gained in the process of investigation, in order to create new materials, products or services, or the improvement of existing ones.

According to the OCDE (Frascati's Manual, 2002), “*Research and Development comprise creative work undertaken in a systematic way to increase the volume of knowledge, including people knowledge, culture and society, and the use of that knowledge to derive new applications*”. With this definition it should be clear that research and development are the basis of innovation, i.e., without these activities the process of innovation cannot be carried out.

In the table shown below, it can be seen the number of Spanish companies that develop activities of research and development (R+D). During the years 2001-2008, the number of companies increases considerably. Then, in the last years, and as a consequence of the economic crisis, the number decreases to 9.500 companies approximately. This table demonstrates the importance of research and development in innovation and in firms in the last years.

TABLE 1. Spanish Companies that develop Research and Development tasks (2001-2013)

Years	Companies
2001	4240
2002	4707
2003	4839
2004	5599
2005	7419
2006	8479
2007	9662
2008	10197
2009	9851
2010	9947
2011	9851
2012	10100
2013	9569

Source: Instituto Nacional de Estadística (INE)

1.3 Exploration and exploitation

The terms of exploration and exploitation have taken importance in recent years. Currently, business world is at a point where companies have a duty to respond to the needs of the market, whether current or future, at the same time that must compete with pressures and constant changes in the environment.

Nowadays, many companies are wrapped in new search activities, and also developing their existing tasks and production routines. The greater competitive pressure has caused companies must follow two functions: achieve survive in the short run, by exploiting its current resources to achieve efficiency (exploitation); and on the other hand, discover new possibilities and ideas to compete in the long run (exploration).

However, the extent in which these two activities tasks must be complemented is a more complex process, because it depends on many factors of the company.

1.3.1 Exploration

According to Nooteboom (1999), *“exploration is an adaptable and flexible process, which must be set up with the company vision, and arises from the individual diversion as a source of innovation”*. This term of exploration can be summarized as the ability that has any company to move quickly to new opportunities, adapt to new markets and avoid being constant, through more or less radical changes.

Activities as the search for new options, variety, innovation, risk... are related to exploration (March, 1991). Creation of new ideas and new knowledge is the essence of exploration for March.

Other studies focus their definition of exploration on organizational changes. For example, Kirton (1976) defines exploration as “*An innovative orientation in relation to organizational change, i.e., the ability to do differently things or consider commons tasks from unexpected angles*”. In this regard, for exploration strategies is better to follow a flexible and flat organizational structure, facilitating individuals work towards the search to new opportunities.

The study of the innovation process by combining the theories of the innovation cycle and the cycle of the product (Vernon 1966), demonstrates how exploration is the first part of this process, characterized by volatility and the generation of new ideas and knowledge. This strategy allows many organizations have new opportunities as a measure of long- term survival.

Following the idea of the innovation process, knowledge generated through exploration is consolidated in the second part of the process (exploitation).

Finally, say that exploration is necessary for any company. Currently, and mainly due to the increased level of competition, any organization has an obligation to innovate their products or services in order to offer something different from the competition, so exploration it's very important to develop these new ideas.

1.3.2 Exploitation

Innovation process is composed of two parts: The first one consists in the pursuit of new opportunities and idea. The other part consists in the development of resources or existing elements in the company in order to seek efficiency. The innovative process not means destroy existing elements to adopt new ones. New ideas can be developed at the same time that exist an improvement of existing ones.

This part of the innovative process focused on the improvement of the elements (resources, capabilities...) existing in an organization, is exploitation. As Vernon (1966) explains in his study of the innovation process “*Exploitation is the second phase of the innovation process where is used the new knowledge acquired through exploration, to improve the work of the organization*”.

According to Nooteboom (1999), “*Exploitation is a refinement of existing technology, involving the coordination of individuals*”. Exploitation refers to the improvement of

knowledge, practices, resources and capabilities of any company, in order to obtain efficiency. Selection of best resources and practical terms, are linked with exploitation.

Kirton (1976), defines exploitation as *“An orientation towards adaptation, focusing on the ability to do better things and the tendency to reduce problems, improving efficiency”*. In this case, for exploitation strategies is better to adopt rigid and integrated organizational structures allowing the existence of common rules and routines to develop efficiently activities. Greater coordination of the activities it's essential to make better things and improve business knowledge.

1.3.3 Dilemma of the exploration and exploitation

Exploration and exploitation are forces which move in the opposite directions. Exploration is the pursuit of new knowledge, while exploitation is the improvement of the existing knowledge in the organization.

One of the basic characteristics of companies is that they haven't got unlimited resources for its economic activity. Therefore, any organization raises the question of how to manage and distribute their resources between exploration and exploitation activities, or focus only in one of them.

In the last years, numerous studies show the need to which companies balance both, exploration and exploitation activities, in order to survive and compete. As Potts say (2000), *“The ends are of poor quality”*. This economist argues the idea that a company using all its efforts and resources in exploitation, suppose inability to new market conditions, in the absence of new ideas (exploration). On the other hand, Potts argues that a company fully explorer, using all of his resources in exploration, will identify the best opportunities in the market, but in absence of exploitation activities, the company cannot operate efficiently and closer to its competitors. Without the improvement of the knowledge generated by exploration, any company cannot compete in the short run.

As the economist James G. March (1991) argues in his theory of the dilemma of learning organizations, *“A fundamental prerequisite for the intelligent adaptation of the organizations is to maintain the balance between the exploitation of all what is already known, and explore everything you can get to know”*.

The paradox that companies faces is based on the need to mix exploration and exploitation in a specific manner, ensuring its survival. To solve this paradox, some authors have elaborated studies and theories trying to explain how to combine the both activities of exploration and exploitation.

For example, March developed a model "*The Dilemma of Learning Organizations*", whose objective was to explain the relationship between exploration and exploitation, as well as explain some implications of the relationship between accumulation and use of Knowledge in organizations. This model supports the idea that its necessary combine activities of exploration and exploitation to survive and compete in the market. However, also explains that to mix both activities, firms have to face with some conflicts, particularly organizational and individual conflicts.

The model of March follows the idea that everyone inside an organization must have an orientation in both activities. For this reason, for this economist, it's very important that a firm develops adequate strategies to work in both senses: generate new knowledge and improve existing knowledge in the organization.

Individual conflicts are other problem that firms have to face. An organization that follows the idea of combine exploration and exploitation has to create a context in which all of his workers are able to manage their total time of work between exploration and exploitation.

The model of March says that any organization that solve organizational and individual conflicts, are able to develop both task (exploration and exploitation) at the same time. Also, the model tries to explain the necessity for organizations to develop this combination of activities, because focuses only in one of these, would suppose the lack of competitiveness.

There are more studies talking about the importance of combining both strategies. For example, the economist Volberda (2006), proposes the idea of combining these activities through various specialized companies. For example, one company focuses in exploration tasks while another focuses on internal operating activities. A clear example of Nooteboom (1999), "*In the pharmaceutical industry, large companies are responsible for the efficient production, marketing and distribution (exploitation), while biotechnology companies are responsible to develop and find new products, new needs in the market (exploration)*".

Other authors follow the idea of the separation of both activities as a way to develop the two. For example, Stalker (1961), "*A company can develop exploration activities for a period of time, and at another point of in time, focuses in activities of exploitation. In this way, a company is able to satisfy actual needs of the market, improving existing products, services and ideas (exploitation), and also, look for new opportunities in the future market (exploration)*".

All these studies have in common the idea of using both activities, and not focus only in exploration or exploitation. All support the importance of the combination of exploration and exploitation as a way to be competitive. Ambidextrous organizations are a clear example that shows the importance of combining the two activities.

1.3.3.1 Ambidextrous organizations

Currently, companies that do not change at all times are doomed to failure due to innovation and the existence of continuous changes. However, firms not only should focus on innovation. They should be able to exploit new opportunities and at the same time work in their current activities to be more efficient.

Ambidextrous organizations are those companies that have the ability to execute its current strategy, at the same time that develops new strategies of tomorrow. This kind of organizations promote both, the adaptability (exploration) and alignment (exploitation).

But to achieve an ambidextrous organization its necessary to find the right balance between exploration and exploitation. To find this balance, and achieve an ambidextrous organization, some authors propose two models:

First, achieve an ambidextrous organization through the structure. The main idea of this model is to separate activities dedicated to today's business (exploitation), with respect the other activities focus on the exploration of new ideas or businesses. Then, exploration activities are organized into independently units with their own resources, structure, and culture, but integrated with the main organization trough ties with high management. Following this structure any company has to two different and independent activities, with the possibility of share resources... Therefore, high management is responsible for defining the structure and provides the balance between both activities.

On the other hand, some authors suggest other model based on the context of the organization. In this case, exploration and exploitation activities are not separated, because are the workers of an organization who decide how to do with their total work time, when to focus on an activity or another. To achieve this situation, any organization must offer a context or environment in which workers are able to coordinate both activities. For example, in commercial businesses, this model is very common, enabling workers the decision about when focus with existing customers or when look for new ones.

However, and despite the fact that there are two models, most of authors agree the idea that these two forms should be complementary. They argue that structural separation is necessary at first, with the goal of the organization to operate in both senses: exploration and exploitation. However, they speculate that this structure should be temporary to get reinstated the exploration activity in the overall structure of the company. So, when the exploration strategy is integrated in the overall structure, the organization must return to adopt integrated structures with both activities.

In the last years, the concept of Ambidextrous Organization has experienced a remarkable importance. This situation is caused by the success that many companies have experienced using an Ambidextrous Organization.

1.4 Exploration and exploitation at universities

In the last 20 years, there was an increase of commercial activities by universities. These organizations have started to combine its main and most traditional activity, teaching and investigation, with a new activity based on the commercialization of the knowledge generated in the traditional activity, through patents, and agreements with other companies.

Authors as Henderson (1998) and Mowery (2002) support the idea that the commercialization activities by universities promote national competitiveness, as well as, suppose for these organizations a strong competitive advantage. Nowadays, the attractiveness of universities not only is measured through the level of teaching, factors such the research level and activities, the cooperation with other institutions, the granting of patents; become very important.

“The creation of the Bayh-Dole Act in 1980 in the United States, has been one of the main causes of this innovative phenomenon at universities” (Henderson et.al, 1998). Through this law, and federal funds, universities started to own their inventions through patents. Since that moment, universities began to develop an activity (commercialization), different from the traditional one, known by many authors as the *“third function”*, which consists in the generation of benefits and a commercial activity through knowledge generated at universities.

Authors such as Owen-Smith (2003) or Etzkovic (2000), consider this process as an *“Academic Revolution”*, in which the marketing activity of universities is becoming the day of these organizations. This evolution assumes the creation of new structures at universities to develop this innovative activity. Also, a high level of entrepreneurship

within universities, links and associations with other institutions, more prepared personal (staff assistant, researches,...).

In the case of universities, the terms of exploration and exploitation refer to the two activities developed for these institutions. For authors as Stren (2004) or Markman (2008), these activities consist in academic research (exploitation), and the commercialization of these research, ideas and technology (exploration).

For these authors, exploitation is the set of tasks that develop universities with the objective of generate knowledge and facilitate the dissemination of this. Exploitation would be linked with the traditional activity of universities such teaching and research.

On the other hand, exploration is related with all activities developed by universities in recent years, and consists in the commercialization of universities research. These activities are new and no related with traditional ones, developed by these institutions. Inside the exploration there are activities such the commercialization of ideas and technology with other companies, the creation of patents or publications on different platforms to share knowledge. It's the set of activities include in that *"third function"* discussed above.

To sum up, for universities, exploitation refers to his traditional activities of teaching and research, while exploration refers to his new activities of commercializing the knowledge generated at the university through patents, agreements with third companies.

"Universities have increased tensions and conflicts between new activities of commercialization, and the traditional ones related with teaching and research" (Chang and Yang, 2008). As it happens in companies, universities have to deal with the problem of combine both activities. The main challenge for these organizations is the creation of a new structure or organizational context to coordinate exploration and exploitation. According to numerous studies, conflicts generated by this combination of activities can be grouped in two groups: Organizational and Individual conflicts.

Authors as Di Gregorio and Shane (2003), defines organizational conflicts are the need for universities to adopt new organizational structures with the aim of combine both activities: exploration and exploitation. As it will be seen later, creation of new structures based on centers and facilities to foster the generation and commercialization of research are essential to carry out both tasks.

On the other hand, individual conflicts refers with the problem that universities face with the objective to manage the whole work of his employees between the two activities: exploration and exploitation. In these conflicts, universities must be capable to generate an environment or atmosphere in which their workers can use his total time in both, teaching and research activities (exploitation), and the commercialization of Knowledge (exploration). Currently, most universities solve this problem through the use of his research and teaching personal, who are capable to distribute their time between teaching and research (Investigation groups, projects,...).

“One of the main challenges for universities is to act as an ambidextrous organization, to solve the problem of combination of exploration and exploitation activities”. Therefore, and equally that happens in other organizations, the best way to solve the problem of the combination of both activities, is create an ambidextrous organization to adapt the context and the structure of universities. Through an ambidextrous organization, universities are capable to develop both activities and the same time, and also, solve conflicts with the structure and with his employees.

Finally, note that there are other factors, different from structural and organizational context that also influence the use of exploration and exploitation activities, and his combination. These factors have not the importance related with structural and context factors, but it can influence the combination and level of exploration and exploitation activities. Size of universities is one of these factors, because large universities have more capacity to develop structures based on a high number of research facilities, and therefore research results such commercialization could be better than other small universities without the capacity to develop equal facilities.

On the other hand, institutional factors can also influence the existence and combination of exploration and exploitation. *“The Bayh-Dole-Act caused an increased in the interest of Governments and other institutions, financing universities research projects and activities to promote marketing research activity inside these universities”* (Phan and Siegel, 2006). For this reason, institutional aspects as Government budgets to universities or approved universities budgets for investigation activities are important to determine the level of exploration and exploitation activities and his combination. If an university have a high level of financial resources from governments or to use in investigation activities, it would be obtained better research results and activities than other with lower financial resources.

To sum up, factors as the university structure, the context inside the structure, institutional aspects and the size of the center or facilities, are essential to combine

activities of exploration with activities of exploitation. Universities must control and develop these factors to achieve combine both activities.

2. EMPIRICAL STUDY

2.1 Research methodology

The main objective of this study is to analyze that more competitive universities are those that more resources use to develop both activities at the same time: exploration and exploitation. Therefore, the study consists on analyze the importance of exploration and exploitation in universities competitiveness.

To develop the study and obtained adequate conclusions, it will be analyzed three different universities in order to research the aspects mentioned in point 1.4 of the theoretical framework. Aspects as the context of the university (the philosophy of operate in both activities), his structural aspects (such as the existence of facilities and services promoting exploration and exploitation activities), individual aspects (availability of teaching and research personal, personal supporting investigation and commercial activities), as well as institutional aspects (budgets) and the size of the university campus and facilities.

Through this in-depth analysis of all aspects, it will be analyze that universities that more resources use in both activities (exploration and exploitation), are the most competitive, those best positioned in front of the whole society.

To develop the study, it has been necessary to structure this in two parts. First of all, it will proceed to study the landscape of Spanish universities as well as the level of competitiveness of these. Also, with this first part, it can be observed the position of each university considering different factors. To carry out this study, it will be use ISSUE Report of 2015 (Rankings about Spanish universities), developed by the Valencian Institute of Economic Research (IVIE) and supported by the BBVA Foundation (secondary sources). This report uses two types of rankings: Productivity level and output level. The difference between the two rankings is the consideration or not of the size of the university. It can observe both rankings at the point 1.7.

Productivity ranking measures competitiveness of Spanish universities considering used resources in each activity. The output ranking measures the productivity and its dimension.

Both rankings are important for the study because the two consider teaching and research activities, and activities related with the transfer of knowledge as patents and collaborations with other studies. For this reason, and following the idea that exploitation activities are related with traditional activities as teaching and research, and exploration with new activities (transfer of knowledge), the rankings are more appropriated.

To include both activities, both rankings have been elaborated through different indicators to show the level of teaching activities, research activities and commercialization of the knowledge. The indicators used in both rankings are explained in the next point of this paper.

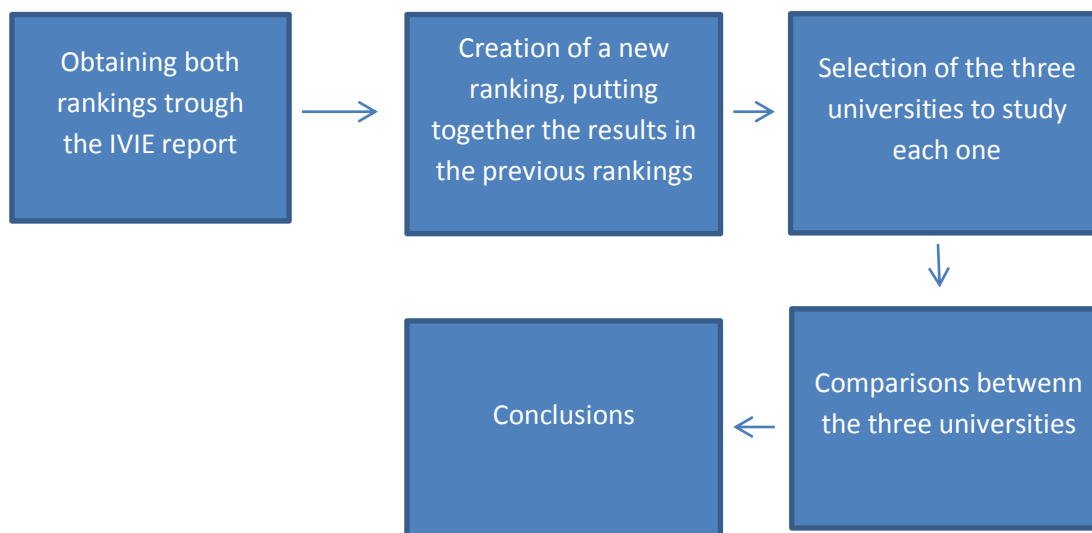
To finish with this first part, and in order to facilitate the analysis of the three universities in the point 2.2, it will be created a new ranking putting together the results obtained in the previous ones (productivity and level of output). The objective of construct this new ranking is, get an overall ranking of Spanish competitiveness universities, considering the two measures of productivity and output, and therefore see which universities have the greatest results, and which universities have the latest ones. The next point explains all with more detail.

The second part of the study (point 2.2), consists in the selection of three universities to develop an analysis of each one. The third ranking constructed in the first part of the study (point 2.1), it used to know which universities are the best, which universities occupy an intermediate position, and finally, which universities have the latest results. To obtain consistent results it will be proceed to select an university inside the fifth greatest universities, an university that occupy an intermediate position, and finally, an university inside the fifth latest universities. With these three universities, it will be seen on what factors are the main differences that explain why these three universities occupy different positions in the ranking.

The study of each university it will be obtained focus on the factors commented in the point 1.3 of the theoretical framework. These factors are the structural aspects, contextual aspects, individual aspects, institutional aspects and final the size of each university. All of these factors consider exploration and exploitation activities, so this study also analyzes the importance of exploration and exploitation activities to obtain a competitive advantage. All of this information will seek on the page of every university so, are secondary sources. In case of not find any type of information in the web pages, it will proceed to contact with each of these universities.

The chart below shows the process which has been followed to carry out the study.

GRAPHIC 1. Procedure followed for the analysis of the study



2.2 Competitiveness study of Spanish universities

This Part will begin with a general analysis of the landscape of the Spanish universities. It will proceed to study which is the current competitiveness of these universities, and observe through different rankings, which positions hold these.

The objective of this first part of the study is to determine which universities are the best, which universities are in intermediate positions, and finally, which universities have the latest results. Through this study, universities occupying these positions can be may selected to proceed to the second part of the study in point 2.2.

Note that for this part of the study, the rankings ISSUE of the 2015 have been used. These rankings have been developed by the Valencian Institute for Economic Research (IVIE), and supported by BBVA Foundation.

During the study it will present two general rankings, including 59 Spanish universities, 11 of which are of a private nature.

Rankings that are going to show include the competitiveness of Spanish universities according to their productivity and output. The difference between these two, is the consideration or not of universities size. As discussed in the theoretical part, size factor can influence the results and commercialization of research.

Therefore, the ranking of productivity is based on indicators fixed by the university size. The goal is to measure production per unit of inputs or used resources. Through this

ranking, it can be possible that a small university get greater productivity from other university with high size, because the first one uses a high quantity of resources.

The volume of results ranking, is based on not relativized indicators with universities size, and depend on both: Universities productivity and dimension. In this case, it's possible a situation in which a large university gets greater results than a smaller one, being more productive the smaller university.

Note that both rankings consider teaching, research and technological development activities of universities. Therefore, both rankings (productivity and output), already covered all of these activities. A series of indicators have been used for the elaboration of these rankings. These indicators consider the three activities (teaching, research and technological development), measuring aspect as the obtained production from each activity, the quality of these activities, resources used in each activity, and the internationalization of the activities. Also, the mentioned indicators have used to construct both rankings.

Indicators used for this study are:

- Teaching activity:
 - Resources:
 - Doctor Professor for every 100 pupils.
 - Budget for every pupil.
 - Doctor Professors and total professors.
 - Production:
 - Success rate.
 - Assessment rate.
 - Drop-out rate.
 - Quality:
 - Index of attract ability.
 - % of graduate students following his studies.
 - Court notes.
 - Internationalization:
 - % of foreign students.
 - % of students in exchange programs.
 - % of students enrolled in non-official languages programs.
- Research activity:
 - Resources:

- Staff doctors contracts, research grants and technical support on budget.
- Production:
 - Quotable documents by Doctor Professor.
 - Doctoral theses.
- Quality:
 - Document dating.
 - % of publications in the first quartile.
- Internationalization:
 - European and International research funding.
- Technological Improvement:
 - Resources:
 - Licensing for every 100 professors.
 - Continuous training per professor.
 - Production:
 - Number of patents.
 - Quality:
 - Commercialized patents per professor.
 - Internationalization:
 - Revenue from international contracts by Doctor Professor.

When both rankings have been analyzed, it will proceed to construct other ranking to plot the results together. The objective to put together both rankings is to determine which universities are the best, and which universities have the latest results, in productivity and output.

2.2.1 Ranking of Spanish Universities Productivity

The ranking of productivity is done with outcome indicators fixed by the size of each university. The objective of this ranking is to measure the competition between the different universities considering production per unit of inputs or used resources.

The table below shows the ranking of Spanish universities productivity. In total, there are 59 universities, 11 of the total are private universities. For this ranking, only has been considered one decimal place, because the consideration of further decimal does not imply any difference between universities. For this reason, there are 10 groups and there are universities which are grouped in the same group.

The rates obtained by each university have been obtained through a weighing using the different indicators explained before. This report gives weight to each activity (Teaching, research, internationalization,...), and according to the efforts of each university, these obtain a certain score (rate).

TABLE 2. Ranking of Spanish Universities Productivity 2015

Ranking	Rate	University	Ranking	Rate	University	Ranking	Rate	University
1	1,5	Universitat Pompeu Fabra	5	1,1	U. Valencia	7	0,9	U. Murcia
2	1,4	U. Carlos III	5	1,1	U. Jaume I UJI	7	0,9	U. Oviedo
2	1,4	U. Aut3noma de Barcelona	5	1,1	U. Ramon Lluch	7	0,9	U. Valladolid
2	1,4	U. Polit3cnica de Catalunya	6	1	Mondragon Unibertsitatea	7	0,9	U. Pa3s Vasco
2	1,4	U. Polit3cnica de Valencia	6	1	U. Complutense	7	0,9	U. Pontificia Comillas
3	1,3	U. Aut3noma de Madrid	6	1	U. Almer3a	7	0,9	U. Rey Juan Carlos
3	1,3	U. Navarra	6	1	U. Deusto	8	0,8	U. Cardenal Herrera CEU
4	1,2	U. Cantabria	6	1	U. Granada	8	0,8	U. Burgos
4	1,2	U. Miguel Hernandez Elche	6	1	U. Huelva	8	0,8	U. Extremadura
4	1,2	U. Polit3cnica de Madrid	6	1	U. Salamanca	8	0,8	U. Ja3n
4	1,2	U. Barcelona	6	1	U. Sevilla	8	0,8	U. La Laguna
4	1,2	U. Internacional Catalunya	6	1	U. Zaragoza	8	0,8	U. Palmas Gran Canaria
4	1,2	U. Rovira i Virgili	6	1	U. Pablo Olavide	8	0,8	U. Europea de Madrid
5	1,1	U. Alcal3 de Henares	6	1	U. Polit3cnica de Cartagena	8	0,8	U. Coru3a
5	1,1	U. Alicante	6	1	U. Vigo	9	0,7	U. Cat3lica Valencia SVte M
5	1,1	U. C3rdoba	6	1	U. Girona	9	0,7	U. Rioja
5	1,1	U. P3blica Navarra	7	0,9	U. C3diz	9	0,7	U. VIC UVIC
5	1,1	U. Santiago Compostela	7	0,9	U. Castilla la Mancha	10	0,6	UNED
5	1,1	U. Illes Balears	7	0,9	U. Le3n	10	0,6	U. Oberta de Catalunya
5	1,1	U. Lleida	7	0,9	U. Malaga			

Source: Own elaboration through the Ranking ISSUE report 2015

Pompeu Fabra university occupies the first position with a rate of 1,5. Then, in the second group and with a rate of 1,4, are the following universities: Carlos III, Aut3noma de Barcelona, Polit3cnica de Catalunya and Polit3cnica de Valencia. Finally, in the third group with a rate of 1,3, universities as: Navarra and Aut3noma de Madrid.

Regard to universities that occupy a intermediate position, they are in group 5 with a rate of 1,1: UJI, U. Valencia and U. Lleida; and in the group 6 with a rate of 1: University of Deusto and U. Cartagena.

Finally, in the last positions (group 9 and 10) are the universities of VIC with a rate of 0,7, and the UNED, and Oberta de Catalunya with a rate of 0,6.

It emphasizes the fact that according this productivity ranking, the differences between the universities are not so notable. For example, among the first university (Pompeu Fabra), and the last one (UNED and Oberta de Catalunya), there is only a difference of 0,9 points. So, according the productivity ranking, competitiveness of Spanish universities is high homogeneous without high differences between them.

Considering private universities, noted that only Navarra University occupies the top positions in the third group of the ranking with a rate of 1,3. Then, there are some like

Ramon Lluch University, Mondragon University or Deusto, who occupy intermediate positions. But, the high number of private universities is in the last positions as the University of Vic, Oberta de Catalunya and Europea de Madrid.

2.2.2 Ranking of Spanish Universities Output

The output ranking is based on indicators not relativized by the size. The results obtained in this ranking are the result of the measurement of productivity in the university and its dimension. So, in this case the dimension of each university can affect the level of output.

The table below shows the ranking according to the level of output or results of the Spanish universities. As the previous ranking, this includes the 59 Spanish universities, 11 of the total are private. In addition, to calculate the results, the study only considers one decimal because adding more not suppose any difference between universities. For this reason, there are universities occupying the same position in the ranking. The calculations of the rate of each university are the same than in the previous ranking using weighing trough the different tasks.

TABLE 3. Ranking of Spanish Universities Output 2015

Ranking	Rate	University	Ranking	Rate	University	Rate	Índice	University
1	4,4	U. Complutense	17	1,3	U. Castilla la Mancha	23	0,7	U. Jaén
2	3,8	U. Barcelona	17	1,3	U. Valladolid	23	0,7	U. Girona
3	3,2	U. Granada	18	1,2	U. Alcalá de Henares	23	0,7	U. Oberta de Catalunya
4	3,1	U. Sevilla	19	1,1	U. Cordoba	24	0,6	U. Huelva
4	3,1	U. Politécnica de Madrid	19	1,1	U. La Laguna	24	0,6	U. León
4	3,1	U. Politécnica de Valencia	19	1,1	U. Vigo	24	0,6	U. Pablo Olavide
5	3	U. Valencia	20	1	U. Cádiz	24	0,6	U. Pública Navarra
6	2,9	U. País Vasco	20	1	U. Rey Juan Carlos	24	0,6	U. Lleida
7	2,8	U. Autónoma de Barcelona	20	1	U. Pompeu Fabra	25	0,5	U. Deusto
8	2,7	U. Politécnica de Catalunya	21	0,9	U. Cantabria	26	0,4	U. Europea de Madrid
9	2,5	U. Autónoma de Madrid	21	0,9	U. Extremadura	26	0,4	U. Politécnica de Cartagena
10	2,3	UNED	21	0,9	U. Palmas Gran Canaria	26	0,4	U. Pontificia Comillas
11	2,2	U. Zaragoza	21	0,9	U. Jaime I UJI	27	0,3	U. Católica Valencia S.V Mar
12	2	U. Santiago Compostela	21	0,9	U. Ramon Lluch	27	0,3	U. Burgos
13	1,8	U. Malaga	21	0,9	U. Rovira i Virgili	28	0,2	Mondragon Unibertsitatea
14	1,6	U. Salamanca	22	0,8	U. Navarra	28	0,2	U. Cardenal Herrera CEU
15	1,5	U. Carlos III	22	0,8	U. Miguel Hernandez Elche	28	0,2	U. Rioja
15	1,5	U. Alicante	22	0,8	U. Coruña	28	0,2	U. Internacional Catalunya
15	1,5	U. Murcia	22	0,8	U. Illes Balears	29	0,1	U. Vic UVIC
16	1,4	U. Oviedo	23	0,7	U. Almería			

Source: Own elaboration through the Ranking ISSUE report 2015

Following the output ranking, the first position is occupied for the Complutense University of Madrid with a rate of 4,4. The second position is for the University of Barcelona with a rate of 3,8. The third position is occupied for the University of Granada with a rate of 3,4. In the fourth position, are the universities of Sevilla, Politécnica de Madrid and Politécnica de Valencia, with a rate of 3,2.

Universities as the Cantabria University, Ramon Lluch, Jaume I (UJI) and Extremadura, occupy intermediate positions. All of these universities are in the 21 group with a rate of 0,9.

Finally, the last positions in this ranking, are occupy for universities in group 28 as the University of Rioja, Mondragon Unibertsitatea, the Univeristy “Internacional de Catalunya” and Cardenal Herrera University (CEU), with a rate of 0,2. The last position in the ranking is occupy for the university of VIC in the group 29 with a rate of 0,1.

Depending on the level of output, the results of the ranking are different from the productivity ranking. In this case, differences between universities are higher. For example, the difference between the first university (Complutense de Madrid), and the last one (UVIC), is 4,3 points. In this ranking, the landscape is more dispersed; there are not groups high a high number of universities due the existence of more differences between universities.

Regard private universities, the ranking shows how the majority of these occupy last positions. For example, private universities as Europea de Madrid, Pontificia Comillas, Mondragon Unbiertsitatea, CEU and VIC, are in the last four groups (10 latest universities). This situation is due to the size of universities. Therefore, according to the level of output, results are not correctly by the size of universities, makes these smaller private universities occupy last positions.

2.2.3 Productivity VS Output Rankings

In this section, the objective is combine the results obtained in the previous rankings (productivity and output) to produce an overall ranking of competitiveness of the Spanish universities, determining what universities are the best (top 10), which occupy an intermediate position, and finally, which universities have the latest results.

The realization of this new ranking will serve to select three universities to analyze in the next point. The table below shows the overall ranking of the competitiveness of Spanish universities, joining the indices obtained in the two previous rankings.

TABLE 4. General Ranking of Spanish Competitiveness (productivity and output) in 2015

University	R. Prod	R. Out	TOTAL	University	R. Prod	R. Out	TOTAL	University	R. Prod	R. Out	TOTAL
U. Complutense	1	4,4	5,4	U. Alcalá de Henares	1,1	1,2	2,3	U. Palmas Gran Canaria	0,8	0,9	1,7
U. Barcelona	1,2	3,8	5	U. Oviedo	0,9	1,4	2,3	U. Huelva	1	0,6	1,6
U. Politécnica de Valencia	1,4	3,1	4,5	U. Córdoba	1,1	1,1	2,2	U. Coruña	0,8	0,8	1,6
U. Politécnica de Madrid	1,2	3,1	4,3	U. Castilla la Mancha	0,9	1,3	2,2	U. Deusto	1	0,5	1,5
U. Autónoma de Barcelona	1,4	2,8	4,2	U. Valladolid	0,9	1,3	2,2	U. León	0,9	0,6	1,5
U. Granada	1	3,2	4,2	U. Navarra	1,3	0,8	2,1	U. Jaén	0,8	0,7	1,5
U. Politécnica de Catalunya	1,4	2,7	4,1	U. Cantabria	1,2	0,9	2,1	U. Internacional Catalunya	1,2	0,2	1,4
U. Valencia	1,1	3	4,1	U. Rovira i Virgili	1,2	0,9	2,1	U. Politécnica de Cartagena	1	0,4	1,4
U. Sevilla	1	3,1	4,1	U. Vigo	1	1,1	2,1	U. Pontificia Comillas	0,9	0,4	1,3
U. Autónoma de Madrid	1,3	2,5	3,8	U. Miguel Hernández Elche	1,2	0,8	2	U. Oberta de Catalunya	0,6	0,7	1,3
U. País Vasco	0,9	2,9	3,8	U. Ramon Lluch	1,1	0,9	2	Mondragon Unibertsitatea	1	0,2	1,2
U. Zaragoza	1	2,2	3,2	U. Illes Balears	1,1	0,8	1,9	U. Europea de Madrid	0,8	0,4	1,2
U. Santiago Compostela	1,1	2	2,9	U. Cádiz	0,9	1	1,9	U. Jaume I UJI	1,1	0,9	1,1
U. Carlos III	1,4	1,5	2,9	U. Rey Juan Carlos	0,9	1	1,9	U. Burgos	0,8	0,3	1,1
UNED	0,6	2,3	2,9	U. La Laguna	0,8	1,1	1,9	U. Católica Valencia S Vte M	0,7	0,3	1
U. Malaga	0,9	1,8	2,7	U. Pública Navarra	1,1	0,6	1,7	U. Cardenal Herrera CEU	0,8	0,2	1
U. Alicante	1,1	1,5	2,6	U. Lleida	1,1	0,6	1,7	U. Rioja	0,7	0,2	0,9
U. Salamanca	1	1,6	2,5	U. Almería	1	0,7	1,7	U. VIC UVIC	0,7	0,1	0,8
Universitat Pompeu Fabra	1,5	1	2,5	U. Girona	1	0,7	1,7				
U. Murcia	0,9	1,5	2,4	U. Extremadura	0,8	0,9	1,7				

Source: Own elaboration through productivity and output rankings of ISSUE Report 2015

In this ranking, the fifth best universities are composed by the University of Barcelona, Complutense de Madrid, Polytechnic of Madrid and Valencia, and finally, the university Autonomous de Barcelona. On the other hand, the fifth universities with lower results are the University of Burgos, Católica de Valencia San Vicente Mártir, CEU, the University of Rioja, and the University of VIC.

As it mentioned above, this ranking will serve to show the competitiveness of Spanish Universities, and select the best university, an university with an intermediate position, and an university with the latest results.

2.3 Study of three spanish universities

This last part of the study consists in the choice of three Spanish universities to study each one and determine why these universities occupy different positions in the previous ranking. In particular, it will select an university with the fifth greatest results, an university in an intermediate position, and an university with the latest results.

As it commented in the research methodology, to obtain and select the three universities it will be used the last ranking in point 2.2, that shown the results of productivity and output together. This rankings is appropriate because shows the competitiveness of Spanish universities and the positions that each university occupies. The table below shows the overall ranking with the total results.

For the choice of the best University it has been extracted from the overall ranking (graph above), the 5 universities with the greatest results (top 5). The table below shows the 5 greatest universities in Spain with respect their level output and productivity.

TABLE 5. Fifth Best Spanish Universities in 2015

University	R. Prod	R. Out	TOTAL
U. Barcelona	1,2	3,8	5
U. Complutense	1	4,4	5,4
U. Politécnica de Valencia	1,4	3,1	4,5
U. Politécnica de Madrid	1,2	3,1	4,3
U. Autónoma de Barcelona	1,4	2,8	4,2

Source: Own elaboration through ISSUE Report Rankings 2015

Then, to study the best University, it has been chosen the Complutense of Madrid University, because despite that occupy the second position, it has a higher prestige and reputation, a very important research activity, and internationally this university is much Known.

For the election of an intermediate university, it has been chosen universities the University Jaume I (UJI), because despite this university occupy an intermediate-lower position in the ranking, it occupies the fifth group in the productivity ranking. Also, this university has a very important research activity. The table below shows the UJI's Productivity. It can be observe how this university occupies an intermediate position.

And finally, for the election of a university with the lowest results (productivity and output level), it has been chosen the last fifth universities. The table below shows which universities have the lowest results. Remember that this information it extracted from the third ranking in point 2.2.

TABLE 6. Universities with lower results in productivity and output in 2015

University	R. Prod	R. Out	TOTAL
U. Burgos	0,8	0,3	1,1
U. Católica Valencia S Vte M	0,7	0,3	1
U. Cardenal Herrera CEU	0,8	0,2	1
U. Rioja	0,7	0,2	0,9
U. VIC UVIC	0,7	0,1	0,8

Source: Own Elaboration through the overall ranking of productivity and output in point 2.2 2015

The University of Vic has been chosen because holds the latest position in the ranking of productivity and output results.

For the in-depth study of each one of the universities, it has been considered the factors discussed in point 4 of the theory. These factors consider exploration and exploitation activities so with this study it can be observed how is the level or resources used in this activities, and check if this results if the factors are related with competitiveness of Spanish universities. The in-depth study will follow the following structure:

- **Size of universities:** To develop this study, it has been used the two rankings of the ISSUE Report. As it commented in point 6, these two rankings measured results of productivity and output. The main difference between two is ten consideration or not of the size of universities (facilities, faculties,...). The two rankings shown different results, therefore the size of universities affect the level of productivity and output.

In relation with the exploration and exploitation activities, it commented in point 4 of the theory, that this factor of the size can influence the level or the existence of these activities. A university with a high size, can develop a high number of facilities oriented to teaching activities, but also with research and commercialization of knowledge. So, high universities may have more opportunities to develop exploration and exploitation activities.

For this reason, it's very important to consider this factor in the study. It will study the size of the university, the number of faculties, and the number of other facilities...

- **Institutional Aspects:** In the point 4 of the theory part, it was commented how since the creation of the "Bayh-Dole-Act", many governments and other institutions started to finance research at universities. For this reason, it's very important to study the finance resources that the three universities hold. This aspect affects the level of exploitation and exploration activities, because a university with a high level of finance resources, it may be develop more tasks of teaching, or use a high quantity of money to research activities..., than other university with a low level of finance resources.

In this study, it will study the finance resources that government post in each Autonomous Community (in this case, Madrid, C. Valenciana and Catalunya) to public universities. Then, also it will study the budget that each university uses in his overall activities.

- **Teaching:** This factor belongs to exploitation activity, where the objective is the generation of knowledge. So study this factor is important to find out how is the level of teaching at each university and how are the main differences between analyzed universities.. Also, study this factor explain how each university uses resources in this exploitation activity.

In this study, it will study the offer of degrees, masters and doctorates, also the possibility of study other languages at the university, the number of teaching staff. In this way, it can be observed the resources that each university uses in teaching activities and the main differences between the three universities.

- **Research and innovation:** At this point, exploration and exploitation activities are mixed. For example, all the activities aimed at the generation of knowledge, will form part of exploitation activities. Tasks such the research at universities trough investigation groups, research projects at universities... On the other hand, activities with the objective of the commercialization of the knowledge generated at universities. So in this case, tasks such collaboration with other institutions to transfer knowledge, elaboration and commercialization of patents. Following with the theory part, traditional activities of the university (teaching and research) are exploitation activities, while new tasks as the commercialization of the knowledge trough patents or other collaborations, are exploration activities.

Study all of these aspects, can be show which university uses more resources in research and commercialization, and therefore which uses more resources in exploration and exploitation activities.

Now it begins to analyze each of the three universities. Once the results are obtained, it will proceed to compare the three universities and observe where the main differences are between them.

2.3.1 The Complutense University of Madrid (CUM)

The Complutense University of Madrid (CUM) is the oldest university in Madrid, considered one of the most important in Spain. The university was founded in 1822, and currently it has two campuses: The Campus of Moncloa and the other of Somosaguas. The historic building is located in the street of San Bernando Malasaña in Madrid. At the international level, the Complutense University of Madrid maintains cooperation agreements with some of the most prestigious universities in the world such Oxford (U.Kingdom), La Sapienza (Italy), and the university of Harvard (United States).

2.3.1.1 The size of the university

Currently, the Complutense University of Madrid has 26 faculties, 9 affiliated centers, 39 colleges, 7 professional and specialization schools, 186 apartments, 36 departmental sections, 13 clinics and university hospitals, 18 centers to support the activity of research (CAI) and scientific and technological facilities (ICTS), 38 halls and 32 libraries.

The 26 faculties are grouped in the following areas: Arts and Humanities, Sciences, health sciences, Social Sciences and Law, and Engineering and Architecture. Most of the facilities are located in the Mocoia Campus with 300 ha of extension. In addition, it has another campus where there are the faculties of economic and business sciences, psychology and political science. The auditorium is located in the Centre of the city (historic building).

It can say that CUM has a fairly high size, mainly due to the importance that this university has.

2.3.1.2 Institutional aspects

The first thing to analyze here is the budget that the Education Ministry allocates in each Autonomous Community, to finance the public universities activities. In this case, the table below shows the budget that the Education Ministry allocates in the Community of Madrid in the year 2010 and 2014 to finance public universities activities. It's important to know that only a part of the total budget is allocated to the Complutense University of Madrid.

TABLE 7. Budgets of the Education Ministry for public universities in Madrid 2010; 2014

	2010	2014
Budget	1.781.336.749,00 €	1.493.097.180,00 €

Source: Own elaboration through data of the Education Ministry

Secondly, it's necessary to analyze the budget which approves each the university and the social council, and the real financial resources that receive from the government. The table below shows the approved budget of the university and the real transfers of money.

It can see how the approved budget by the university decreases in the last 5 years, as a main result of the economic crisis. On the other hand, the table also shows how the transfer of money by the government is less than the approved budget.

TABLE 8. Approved Budgets from the Government to the Complutense University of Madrid 2011-2015

Year	Initial Income Budget	Current Transfer	Capital transfer	Percentage
2015	518.127.373,00 €	295.288.033,00 €	4.791.597,00 €	57,92%
2014	510.625.963,00 €	295.935.573,00 €	3.728.675,00 €	58,69%
2013	516.095.032,00 €	316.836.728,00 €	6.134.800,00 €	62,58%
2012	536.586.439,00 €	367.295.440,00 €	8.661.973,00 €	70,08%
2011	595.577.038,00 €	416.246.320,00 €	11.183.390,00 €	71,77%

Source: Own elaboration through data from the Complutense University Transparency Portal

2.3.1.3 Teaching at the Complutense University of Madrid

In this section of teaching, there are only exploitation activities. This activities focus in teach at the university and the generation of knowledge.

- **Degree offer:** The CUM offers a total of 81 degrees divided among the different studies branches: Arts and Humanities, Health Sciences, Pure Sciences, Engineering and Architecture, Social and Legal Sciences. Also, dual degrees, such the degree of business and law management.
9 of the total 81 degrees are in English. The objective is to encourage language learning and improve quality and competitiveness of these degrees and the university. For example, business studies, economics, computer science, and others.
- **Offer of Master's degrees:** The CUM offers a total of 169 masters divided into the different commented branches of study. 4 of the total 169 master's programs are in English to the objective to be more competitive.
- **Doctoral degrees:** The CUM offers a total of 58 doctoral programs included in the study branches such Arts and Humanities, Health Science, Engineering and Architecture Sciences, and Social and Law Sciences.
- **Scholarships:** Equal to the rest of universities, there is a scholarship of the Education Ministry. Also, the CUM offers the following scholarships, thanks to different contracts or projects with other institutions:
 - **Degree Scholarships:** The CUM offers scholarships to collaborate in different departments, for international mobility, and to produce different research programs elaborated by students.
 - **Masters Scholarships:** The CUM offers scholarships to collaborate in different departments, to research in investigation facilities...
 - **Doctoral Scholarships:** Scholarships and contracts to work at the university, continuous training for doctoral staff, and scholarships to

elaborate project to improve the investigation. For example, the scholarships as a result of the Carolina Foundation.

- **Language offer:** The CUM has “Centro Superior de idiomas Modernos (CSIM)”, with an offer of more than six languages to study (English, Italian, French,...). Also, exists “Centro Complutense para la Enseñanza del Español” to teach foreign students to learn Spanish.
- **Teach Services:** In addition, the CUM offers a range of services such museums inside the university, libraries, and other facilities to study and improve the knowledge, facilities to students home...
- **Teaching staff:** In the CUM, the staff is divided into two large groups: Teaching and Research Staff, and Administrative and Service Staff. In the CUM, the 59% percent of the workers are teachers and investigators, and the other 41% are Administrative and Service staff.

Now, these Teaching and Research Staff is composed by:

- Teach and Research staff: Personal that combines the task of teaching and investigation into investigation groups. In 2014, the CUM had 5854 teachers in their faculties, and 19 in other centers.
- Researchers and Personal outside the university: Only focus in tasks of research. In 2014, 482 workers of the CUM are researchers.

2.3.1.4 Research and Innovation activities at the Complutense University of Madrid

In this section, there are both, exploration and exploitation activities. First, research and innovation activities focus on the generation of knowledge (exploitation activities). In this group, there are the research centers, research groups, research staff, research programs and projects.

Secondly, innovation and research activities focus on the commercialization of the knowledge generated at the university. Activities and facilities such Technologic Transfer Offices, creation and commercialization of patents, agreements with others institutions to commercialize the knowledge.

2.3.1.4.1 Research and Innovation in the CUM

In this section there are all the activities, centers, facilities and the structure, that allow and encourage research and innovation activities in the Complutense University of Madrid. All of these are exploitation activities (generation of Knowledge).

- **Research Groups:** Currently, the CUM holds over 600 research groups across the different faculties of the University. This research groups are composed by

the Teaching and research staff workers who combine their total time between the two activities.

- **Research Assistance Centers (CASI-ICTS):** This University has the support of 18 centers of research assistance. For example, there is the Animal House of the CUM, whose main function is the breeding and supply of animals for experimentation. There is also a center of x-ray diffraction for the measurement of crystalline phases and chemical elements, in samples of diffraction and x-ray fluorescence.
- **University Research Institutes:** The CUM holds 38 technological institutes. The function of these is to serve as a basis for teaching and research, specializing in different areas, and using its resources and research groups. For example, the Environmental Sciences Institute (IUCA), whose main functions are the realization and promotion of research in this area, cooperation with other environmental institutions, encourage research and environmental development.
- **International Excellence Campus “The Moncloa Campus”:** This campus aims to be a center of reference in Knowledge and technology, especially in areas related to science and technology. This increases the global impact of scientific publications, improves the resources (human and material) for research, multiplies the number of stays post-doctoral of foreign people on campus, and increases the participation in international research projects.
- **“Parque Científico de Madrid UCM-UAM):** This is a nonprofit foundation created in 2001 by the Autonomía University of Madrid and the Complutense University of Madrid, both scientific entrepreneurship and technological innovator. Through collaboration with other entities such The Chamber of Commerce in Madrid, Santander Bank, and other institutions are encouraged to this innovative and research aspect.

2.3.1.4.2 Research Bodies of Management

In the figure below, it can see a chart on that are the responsible or centers that carry out the management of all research activities.

GRAPHIC 2. Management Research Organization Chart



Source: Annual Memory of the research budget of the CUM

2.3.1.4.3 Management and Support Offices and Services for research and innovation

In this case, the Complutense University of Madrid has the office of support to research (OAI), and a series of services offered to promote and support these activities.

- **Office of Support to Research (AOI):** Responsible for capturing resources in national and international competitive calls, strengthen linkages between research groups of the CUM and other institutions. Other function of this office is support the promotion and management of research projects. The AOI is composed by:
 - **European Office of Research:** It was created on 17 December of 1998. Its main function is to increase Spanish participation and leadership of universities and public institutions of research in European research projects. The European Office encourages the Spanish participation in “Horizon 2020”, tracking the European institutional issue related to science and technology, which is particularly concerned with public universities and public research institutions.
- **Results Transfer Office of Research (OTRI):** This office was created in 1989 as a body between the University and other companies to promote relationships between both sectors, developing the transfer of University scientific and technical supply to the productive sector. The main functions of this office are:

- **Research funding:** The OTRI is responsible for the management of all the funding that other institutions allocate at the Complutense University of Madrid.
- **Technology Commercialization:** The OTRI is responsible to support all of the CUM researchers to elaborate investigation and transfer these to other companies or institutions. Also, this office manages the contact process between the University and other companies.
- **Patent Management:** The OTRI is responsible of the management of all the investigation produced at university, and transforms this investigation into benefits with the elaboration of patents.
- **Scientific Culture:** The OTRI promotes different programs to foster the research activity at the University. For example, the Science Week or the Researcher's Night.
- **Offer External Advice Research Contracts:** Contracts different projects with other companies to obtain benefits. These studies are stipulated with companies and sector with favor benefits for College.
- **Branch Network of Research Support Centers:** The OTRI is the responsible to manage different offices in each of the faculties, to promote and help the personal to do research activities.
- **Complutense University of Madrid General Foundation:** It was founded in 1984, as a result of the merger of 18 foundations of the CUM, and fruit of private donations. Its responsible for the management of research activities, the continuous training of the researchers, and the knowledge transfer. Also, it provides information about research at CUM, and promotes the elaboration of different research projects. Basically, its main function is to manage everything related to research and innovation activities.
- **Research services:** services provided by the UCM and other institutions, with the aim to promote research activities at university. Through this service, you can find the different calls for scholarships and research grants, calls for projects, calls for the mobility of researchers.

2.3.1.4.4 Research staff

The UCM holds 59 percent of researcher and teacher staff, and a 41 percent of administrative and services staff.

In relation with researchers, the UCM has nowadays a total of 482 in their own faculties and 18 in other centers.

2.3.1.4.5 Research results and budgets of the UCM

In this section it will be seen the budget destination of the UCM in research and innovation activities.

Then, the number of patents elaborated by the UCM as a indicator of research results. Publications on scientific journals are also other indicator to measure the innovation results at this university.

- **Research and innovation budgets:** The table below shows who are the main entities that allocate resources to the UCM research activities. The Economy and Competitiveness Ministry is the entity with a higher contribution in the UCM research activities with a 34 percent of the total budget. At second place, programs of the European Union with a 20% percent of the total funding budget. The university provides a total of 3.493, 094€, only a 7 percent of the total research funding.

The 81 of the total research funding comes from public funds, while the 19 proceeds from private funds. With regard to the origin of that budget, the table below shows that research activities, in particular, is addressed.

The second table shows how most of the part of the budget it was allocated to research projects and support researcher staff. These two activities represent the 59 percent of the UCM research budget.

- **Patents of the UCM:** throughout its history, the UCM has developed a total of 290 patents. The table below shows the total number of those patents spread according to the research area.
On the other hand, the table below shows patent application of the UCM during the years of 2005 to 2013.
- **Research publications:** the UCM has more than 200,000 documents in open access. Moreover, it has a total of 32.008 articles in journals of different categories like scientific, historical area...

2.3.2 Jaume I University (UJI)

The UJI is a Public University located in the North of the region of Valencia, specifically in the city of Castellón. Created in 1991, the University is characterized by its personalized service, agility in administrative processes and a high level of participation of its members in University life. The UJI has an integrated campus, a series of modern, functional and sustainable facilities.

In addition, this University is also characterized by its high application of information and communication technologies (ICT), in most of their processes of teaching, research and university management.

Finally, the management of the quality conducted at this University has served so that in 2008 it was awarded the label of European excellence gold 500.

2.3.2.1 Size of the University

Currently, Jaume I University (UJI) has a total area of 756.566 m². 573.318 m² are urbanized area and 201.729m² are floor area. On the other hand, the university has 95.000m² of sports facilities.

The UJI has a large building in the center of campus (Agora) called rector, whose main function is to carry out most of the administrative management of the University. In addition, the UJI has a total of 4 faculties, the Faculty of Humanities and Social Sciences, the Faculty of Law and Economics, Faculty of Health Sciences and the School of Technology and Experimental Sciences. It also has a doctoral school and a total of 27 apartments spread between different faculties.

Moreover, the university has many buildings supporting research activities as the Office of Cooperative Research and Technological Development (OCIT), the University Library, the Science, Technology and Business Park UJI (Espaitec).

Finally, the UJI has different sport facilities spread over different areas (Tennis courts, university pool...).

2.3.2.2 Institutional aspects

The table below shows the budget allocated by the Ministry of Education for Valencian Community public universities during the years 2010 and 2014. It can be seen that budget decreases as a result of the economic crisis the country faces. A percentage of that budget is allocated in the Jaume I University (UJI).

TABLE 9. Ministry of Education budget for Valencian Community Public Universities (2010-2014)

	2010	2014
Budget	1.151.954.462,00 €	1.008.594.147,00 €

Source: Ministry of Education data

Secondly, 2015 approved Budget by the university has been 91.528.000€, a 3, 42% less than the previous year. Generalitat Valenciana has provided a total of 61.159.459,

19€. The rest, € 18,777,706 is income that the university has provided for tuition fees and other income.

2.3.2.3 Teaching activities at the UJI.

In this great section appear all activities related to the teaching of skills. Therefore, they are all exploitation activities.

- **Degree offer:** The Universitat Jaume I (UJI) offers a full 31 degrees grouped in the following areas of study: Social and Legal Sciences (13 degrees), Arts and Humanities (4 degrees), Engineering and Architecture (10 degrees), Pure Sciences (degree in Chemistry), and Health (3 degrees).

In addition, the UJI offers the possibility of taking 9 doubles titles, of which 4 are international in collaboration with some European universities such as Lyon or Toulouse (Degree in Business Administration, Finance and Accounting, and Economics).

- **Offer of Master's degrees:** The UJI offers a total of 49 masters grouped in the 4 faculties of the university campus. The Faculty of Humanities and Social (15 masters) Sciences, the Faculty of Law and Economics (10 masters), the Faculty of Health Sciences (7 masters), and the School of Technology and Experimental Sciences (17 masters).
- **Doctoral Degrees:** The UJI offers a total of 19 doctoral programs grouped in the following areas of study: Science and Technology, Health Sciences, Humanities and Social Sciences, and Law and Economics
- **Scholarships:** in addition to the scholarships awarded by the Ministry of Education and the Generalitat Valenciana, the UJI offers scholarships in general for the whole university community according to their performance. It also offers scholarships for Bachelor, Master and PhD for students from impoverished countries, scholarships for students with special situations (death of any of the family), and scholarships for the study of master in International Peace Studies, Conflict and Development.
- **Language offer:** The UJI has the Language and Terminology Service (SLT), whose main objective is to organize and meet all the needs that the university may have on languages. Inside this service exists the training area, comprising more than 100 different courses in languages, watching the Catalan, English, German, French, Italian, Portuguese and Chinese.

Conversation groups are also used in different languages to promote the learning of languages. Finally, note that the accreditation service organized

language tests.

There is also a self-learning platform for languages, within the SLT, called Language Learning Centre (CAL).

- **Teach Services:** The UJI is also characterized by the large number of services offered. The university has 30 platforms or services to offer as the Language and Terminology Service (SLT), the Sports Service, the Socio-cultural Activities Service (SASC), the Office of International You relate (ORI), the Office for Job Placement and Practices (OIPEP), the Library, and many others.
- **Teaching staff:** As happens in many other universities, UJI staff is divided into two main groups: teaching and research staff and administration and services staff. Currently, Administration and Services staff is about a 31.7% with 617 employees. Moreover, Teaching and Research staff represents an 88.83% with 1329 employees.

2.3.2.4 Research and innovation activities at the UJI.

As mentioned above, the research and innovation belong to exploitation and exploration tasks. Those research activities aimed at the generation of knowledge will be grouped as exploitation tasks. In addition, the tasks of research and innovation aimed at transferring the knowledge generated to obtain some benefit are exploration activities.

2.3.2.4.1 Research and Innovation at the University

In this section there are activities that generate and improve knowledge at the university. For this reason, these are exploitation activities.

- **Research Institutes:** Research institutes are those who specialize in a specific area, and serve as a basis for teaching and research universities. The UJI has a total of 11 research institutes. For example, there is the Interuniversity Institute for Local Development (IIDL), the Transport Law Institute (IDT), or the Institute of New Imaging Technologies (INIT).
- **Research Groups:** Research groups at UJI are grouped into the different departments of the faculties of the campus. The table below shows the total research groups that own the university grouped by the various faculties. In total, the UJI has 165 research groups. Noting that these also be grouped by faculties, they are also departments. That is, within each faculty there are different departments among other things, order to create their own research teams.

TABLE 10. Research Groups at UJI according faculties (2015)

Faculty	Research Groups
College of Technology and Experimental Sciences	66
Health Sciences	28
Human and Social Sciences	40
Legal and Economics Sciences	31
TOTAL	165

Source: Compiled data through the website of the UJI

2.3.2.4.2 Research Management

The management of most tasks of innovation and technological development in the UJI is performed by the Office of Cooperative Research and Technological Development (OCIT). Inside this great service, there is a structure formed by a general director of research, and various departments that handle different tasks:

- **Direction:** Ismael Rodrigo Martinez
- **Department 1:** Pilar Sinisterra and Angela Belenguer Balaguer Marmaneu.

Functions:

- Research projects.
 - Aids or infrastructure.
 - Special actions.
 - Programs incorporating researchers.
- **Department 2:** Cristina Villarroja Berges. Functions:
 - European projects.
 - Creation of technology-based companies.
- **Department 3:** Pilar Rodriguez and Emma Polop Carot Lechner. Functions:
 - Research contracts Art. 83 LOU.
- **Department 4:** Maribel Ruiz Gil and José Miguel Sanahuja Ten. Functions:
 - Pre and post-doctoral fellowships.
 - Scholarship or charge d projects and contracts.
 - Employment contracts in charge of projects and contracts.
- **Department 5:** Almudena Robert Flors, José Alberto Roy Oliveros and Rafael Borrás Siurana. Functions:
 - Scientific and technological offer and relations with companies.
 - Registration or research groups.
 - Cataloging and scientific production (research data system).
 - Aid to research groups and mobility aids.

- **Department 6:** Hugo Cerda Tuesday. Functions:
 - Industrial property and technology transfer.
 - Relationship or companies.

2.3.2.4.3 Offices and management services and support for research and innovation at the UJI

Services and institutions that provide support for research at Universitat Jaume I (UJI) are:

- **Scientific Culture and Innovation Unit:** A working group created in 2011 with the aim of channeling and enhances communication activities and dissemination of science, technology and innovation at the Universitat Jaume I. Also reinforces the work of other university services to achieve breakthroughs on campus. The objectives of this institution are:
 - Disseminate the results of the research groups and knowledge generated in the UJI.
 - Promoting scientific culture or the environment and society as a whole.
 - Contribute to the training of research staff in scientific communication activities at UJI.
 - Foster scientific vocations and innovative talent.
 - Promote accessibility to the content of science and multilingualism.
- **Office of Cooperative Research and Technological Development (OCIT):** The OCIT is attached to the Vice President for Research and Graduate Studies Service, whose main function is to promote and manage research activities and technological innovation of the UJI from two perspectives:
 - Promoting University-Industry Collaboration through the connection between the knowledge generated by researchers and needs of businesses and organizations.
 - **Research groups:** Manage the knowledge generated by these research groups.
 - **Management of Patent Portfolio:** Manage all administrative processes for applying for patents, patent processing ...
 - **Espaitec:** Collaboration between companies and university.
 - Support the participation of research groups on public funding programs for R & D.

- **2015 Research Promoting Plan:** Formed by five different programs in order to encourage research projects, support research staff, research staff training that ...
 - **Calls for research grants:** Different types of calls made by many institutions to promote research.
 - **European R & D projects:** Funds of the European Union for the period 2014-2020. Based on the "HORIZON 2020" program which seeks the promotion of European research and innovation in numerous institutions such as universities ...
 - **Scholarships to research at the UJI:** Scholarships in charge of different projects promoted by the faculties of the UJI and the colleges it has.
 - **Data System Research:** OCIT, through this system, is responsible for the management of all procedures, data .., from research activities and technological innovation.
 - **Research Groups Registration:** responsible for managing the creation of new research groups (applications, acceptances, ...).
 - **Intellectual property:** The OCIT is responsible for the administrative management of the intellectual property of the UJI.
- **UJI Library:** The database of bibliographic reference, specialized magazines and technological ... The library is the basis for the generation of knowledge, support for research work ...
 - **Central Scientific Instrumentation Service (SCIC):** SCIC integrates advanced scientific infrastructure in the field of experimental research of the UJI in order to support their own research groups and other institutions or companies within the environment of the University.
 - **Business, Science and Technological Park (Espaitec):** Promoted by the UJI and the Confederation of Employers of Castellón (CEC), the aim of Espaitec is to create an environment reference in Castellon directed to accept, support, promote and growing innovative business initiatives. It also facilitates the active transfer technology developed at the university.
 - **Ethics Committee:** The University is aware of its duty and responsibility towards society, is a commission that provides answers to current and future needs that arise regarding the scientific research conducted in their area, overlooking and protecting the rights key people, the animal welfare and the

environment, and respects the principles and commitments of the UJI bioethics.

- **Animal Research:** Provide optimum experimental and teaching research staff, upon request, in relation to animal testing work. These facilities can also use public or private companies that require it.

2.3.2.4.4 Research Staff

As mentioned above, the entire staff of the UJI is divided into two groups: the Administration and Services Staff (PAS) and the Teaching and Research Staff (PDI). In the UJI, the 88.83% of teaching and research staff (1329 employees).

2.3.2.4.5 Research Activity Results and Budgets at the UJI

First, the budget allocated at the UJI to research and technological activities. By 2013, the UJI allocated 7,444,843€ to research activities. The number of projects that were in effect amounted to 273, and there were 208 research contracts with other institutions.

Secondly, UJI results obtained through the research and investigation are:

- **Patents:** The table below shows the number of patents that the university has requested over recent years.

TABLE 11. Patent Application by the UJI during 2005-2013

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL
Patent Applications	1	2	4	2	0	3	5	2	5	24

Source: Compiled data by the report of the Spanish Patent and Trademark Office (SPTO)

In the above table it can be seen as the UJI has requested in the past 10 years a total of 24 patents. However, the portfolio of patents owned by the university currently is 7.

- **Publications of investigation results:** The publication of the research conducted at the university is another index to measure the results obtained from this process of research and technological development. In the case of the UJI, these results are reflected in the university repository (library) that is characterized by:
 - A total of 2694 publications in journals published by university departments.
 - A total of 5231 scientific papers as a result of scientific production carried out by different members of the university community.

2.3.3 The University of Vic (UVIC)

The University of Vic de Catalunya or Universitat Central, with public and private management, provides its public service activities in the areas of teaching, research and knowledge transfer in the fields of its own. It was founded on May 21, 1997.

Its mission is to become a driver of knowledge and innovation for territory and internationally oriented. The student services, global education, professional rigor and social commitment are some of the values pursued college. UVic is governed by the Balmes University Foundation, providing a system of public control and private management, providing a model of efficient, responsible and responsive government.

2.3.3.1 The size of the University

The University of Vic is characterized by a smaller size with respect to the two previous universities. If it is found in paragraph 7, the productivity ranking of Spanish universities, can be seen as UVic occupies the last position, which is that when considering the size of this, makes the results in both teaching and research are minors.

The university consists of two campuses: Campus and Campus Miramarges Tower Friars. Regarding Campus Miramarges, noting that consists of 8 buildings: the Rector, the Faculty of Health and Welfare, the Faculty of Education, Translation and Human Sciences, "Ricard Torrents" library, the Departments of the Faculty Business and Communication College of Business and Communication, the Technical Office of the Vice President for Research and Knowledge Transfer, and the Center for Health and Social Studies. In addition, this campus also has a garden fostering life on campus.

In addition, "Frares Campus" is more oriented to scientific and research studies, is composed of the following buildings: Frares Masia Towers and the Frares Tower building, where the Polytechnic School is located.

2.3.3.2 Institutional Aspects

In this case it's necessary to analyze the budget allocated by the Ministry of Education for the Catalan public universities, and budget or income that the University of VIC has.

First, the table below shows the budget allocated by the Ministry of Education to finance Catalan public universities.

TABLE 12. Ministry of Education Budget for the Catalan public universities 2010; 2014

	2010	2014
Budget	1.594.231.327,00 €	1.297.896.181,00 €

Source: Own elaboration through Ministry of Education data.

Secondly, it's necessary to analyze the budget of the University of Vic. The table below shows the income and the source of procurement that the UVic has earned in recent years.

TABLE 13. UVic Revenue by source 2012-2015

	2012-13	2013-14	2014-15 (forecast)
Revenue/Budget	31.408.511,95 €	32.843.306,36 €	33.528.323,00 €
Own Income	20.926.762,88 €	21.461.180,00 €	23.383.125,00 €
Contracted Programs	6.608.416,00 €	6.675.493,00 €	6.675.493,00 €
Grants	3.873.333,07 €	4.706.633,36 €	3.469.705,00 €

Source: Own elaboration through Transparency Portal of the UVIC

From the above table it can be seen as the income level of the 2013-2014 amounts to € 32,843,306.36.

2.3.3.3 Teaching at the university

Activities are grouped into exploitation activities, since the objective pursued is the teaching itself, and the generation of knowledge. The knowledge generated for results or some sort of economic benefit, as when patents are used...

- **Degree offer:** UVic offers a total of 33 degrees grouped in the following areas of study: Arts and Humanities (4 degrees), pure sciences (6 degrees) Health Sciences (5 degrees), Social Sciences and Law (11 degrees), and Engineering and Architecture (7 degrees).
- **Offer of Master's Degrees:** Currently, UVic offers a total of 16 Masters grouped in the following areas of study: Arts and Humanities (3 masters), pure sciences (1 master), Health Sciences (3 masters), Social Sciences and Law (8 masters) , and Engineering and Architecture (1 master).
- **Higher Level Training Cycles:** UVic is also characterized by the offer of three cycles of higher grade such as: Processes and Quality in Food Industry (Central Kreas), 3D animations, Games and Interactive Environments (Teknos Center), and Development Multiplatform Application (Teknos Center).
- **Doctorates:** The UIC has 12 doctoral programs. These are divided into two groups:

- **Doctoral programs for new students: A total of 6 doctoral programs:**
 - Gender Studies: Culture, Society and Policy.
 - Experimental Sciences and Technologies.
 - Comprehensive cures and health services.
 - Law, Economics and Business.
 - Innovation and Educational Intervention.
 - Translation, Gender and Cultural Studies.
- **other doctoral programs for students who continue at UVic: A total of 6 doctoral programs:**
 - Systems Biology.
 - Interactive Digital Communication.
 - Inclusive Education.
 - Health, Welfare and Quality of Life.
 - Digital Technologies and Information.
 - Translation, Languages and Literatures
- **Scholarships:** In addition to the general grants to all universities which are the Ministry of Education and each of the governments of the CCAA, UVic offers the following scholarships:
 - **Ajut UVic-UCC:** Aid offered by the university itself as the economic situation and the family.
 - **Scholarships according to talent:** UVic offers educational scholarships to talented academic excellence ...
 - **Becas Sí-Sí:** Scholarships that help students to find a job while studying.
 - **Practicas externas no curriculares con beca de estudio UVIC:** Beca de colaboración para comenzar en el mundo laboral con adaptación del horario de estudios...
- **Language Training:** UVic has Language School is an academic service with the aim of promoting multilingualism in society and especially in the university community. Through this school, students can form in different languages and also have the possibility of accreditation exams levels. The languages that offer this service are English, French, German, Italian, Chinese, and Spanish for foreign students.
- **Services:** In addition, UVic offers a range of services that promote the teaching activities such as the library, offering online and blended studies and the degree

of Translation, Interpretation and Applied Linguistics, University of summer with a series of related courses with different areas of study ...

- **Teachers:** UVic has a total of 544 teachers distributed among the different faculties (536) and the School of Languages (8).

TABLE 14. UVIC Teachers Distributed among the different faculties (2015)

Faculty	Teacher staff
Faculty of translation, education and human sciences	193
Faculty of Health and Wellness Sciences	158
Higher Polytechnic School	97
Faculty of Business and Communication	88
Language School	8
TOTAL	544

Source: Obtained data form the website of the University of Vic

2.3.3.4 Research and Innovation activities at UVic

In this case, exists both types of activities. For one side, activities developed at the university to generate new knowledge. For the other side, activities with the objective of share the knowledge with other institutions to obtain an economic profit.

2.3.3.4.1 Research and innovation at UVic

Exploitation activities in order to generate new knowledge beneficial to the university campus as teachers, students...

- **Research groups:** Nowadays, the university has 23 research groups distributed between different branches of study. The table below shows the different research groups has UVic by branch of study or faculty to which it belongs:

TABLE 15. UVIC Research Groups according the different branches of study (2015)

Research Branch	Research Groups
Arts and Humanities	3
Pure Sciences	2
Health Sciences	3
Social Sciences	13
Engineering	2
TOTAL	23

Source: Own elaboration through Uvic website

2.3.3.4.2 Innovation Management System

The organs that manage everything related to research and knowledge transfer at UVic are:

- **Vice President for Research and Teaching:** The science policy guidelines are established from this body. Some of its features are:
 - Enhance the search areas of specialization at UVic.
 - Promote the search and promote internationalization.
 - Evaluate search activities.
 - Promote and support research activities of teaching and research staff (PDI).
- **Search Committee:** Advisory body on research and knowledge transfer. Consists of 11 members. Some of its features are:
 - Encourage the growth and consolidation of the search lines UVic.
 - Develop the regulations and procedures related to the activity of research and knowledge transfer.
- **Technical Office of “Recerca i Transferència de Coneixement (OTRI)”:** It supports doctoral programs and manages everything related to the research activity.
- **Doctoral School:** It organizes academic and administrative management of the activities of doctoral studies, academic quality ...

2.3.3.4.3 Offices and management services to support research and innovation activities at Uvic

In this section there are facilities and services with the objective of transfer with other institutions the knowledge generated at the university, to obtain an economic profit.

- **Chairs:** Units that enable collaboration between UVic and other public and private entities to generate scientific and technological knowledge, in addition to transfer to society and the productive sector. Each institute focuses on its scope. Currently, UVic has 9 chairs:
 - Chair of Palliative Care.
 - Chair of Qualitative Research.
 - Chair of Social Services.
 - Chair of ICT and Health.
 - UNESCO Chair in Women, Development and Cultures.

- Verdaguer Chair of Literary Studies.
- Chair of Water, nature and wellness.
- Chair of AIDS and related diseases.
- Chair of Bioethics.
- **Centers of Research and Knowledge Transfer (CERT):** Complement activity of UVic departments in thematic areas of interest to the faculties and the university. In addition, they generate, apply and disseminate knowledge by conducting research and organizing cultural activities ... There are 4 centers:
 - Interdisciplinary Gender Studies Center (CEIG)
 - Center of Health and Social Studies (CESS)
 - Technology Centre Biodiversity, Ecology and Environmental Management Technology (CT TECNIO BETA)
 - Studies Center of Sport and Physical Activity (CEEAF)
- **Conferences and Congresses:** Different types of activities and meetings with the aim of encouraging research activities on campus. Examples 13th Congress as "Science for Children" or "Science Week 2014".
- **Technical Office of "Recerca i Transferència de Coneixement (OTRI)":** Technical Office supporting doctoral programs and manages research activities, transfer of knowledge and actions of scientific popularization of UVic. It consists of 4 units: Doctor's office, the Management Unit of the Research Unit of Assessment and Knowledge Transfer and Outreach Unit. Among its main objectives is:
 - Show support for the Doctoral School.
 - Facilitate access to research grants and research programs, knowledge transfer, innovation and science communication personnel.
 - Manage or support from internal and external research (regional, national, European and international).
 - Enhance the organization of popular science activities.

2.3.3.4.4 Staff Researcher

Currently, UVic has a total of 204 researchers in their research groups. The table below shows how the number of researchers is distributed between different branches of study with which the university operates.

TABLE 16. Number of Researchers by Discipline at Uvic

Research Branch	Research Staff
Experimental Sciences	39
Medical and Health Sciences	16
Human Sciences	37
Social Sciences	112
TOTAL	204

Source: Own elaboration through the Uvic web.

2.3.3.4.5 Research activity results and budget at Uvic

First, it's important to analyze the Budget allocated to research activities at the university. The table below shows some economic accounts in connection with such activities.

TABLE 17. Uvic economic operations in research and technological development.

Concept	Budget
Investigation	- 2.017.424,00 €
Income	514.566,00 €
Staff	- 2.187.915,00 €
Indirects Costs	- 344.075,00 €
Knowledge transfer	32.299,00 €
Income	257.970,00 €
Staff	- 116.067,00 €
Indirect Costs	- 109.604,00 €
Doctoral school	- 321.032,00 €
Income	218.199,00 €
Staff	- 464.971,00 €
Indirect Costs	- 74.260,00 €
Research Groups Investment	7.500,00 €

Source: Prepared Data by Strategic Economic Viability Plan of Uvic

With respect to the results Uvic obtained from research and innovation, noting that has not been able to find anything about holding patents or these, so it is conceivable that Uvic has not yet developed such activities.

- **Publications of the results of research:** Note that the Institutional Repository Uvic is characterized by having a total of 966 publications including articles in journals, conferences and books. It also has a collection of 30 research papers, 36 doctoral theses and 48 research works (dissertations, diplomas of advanced studies ...).

2.4 Comparison of the three universities

Once the study is completed thoroughly each of the three universities, it's necessary to compare them with the aim of identifying where are the greatest differences and try to analyze why these differences are the cause of these universities occupying different positions in the rankings elaborated in point 7.

The structure followed during the comparison is the same that was used during the study of the three universities. That is, it will start with the size of the universities, institutional aspects, teaching, and finally, the study of research activities and technological development.

2.4.1 The size of the universities

Before comparing the three universities, it should be noted that this factor is not significant enough to determine and draw conclusions about the level of exploitation and exploration tasks. However, as it was found in paragraph 6 of shall rankings, consideration or not the size of the university, modifies position between universities.

With respect to the three universities studied, commenting that the Complutense University of Madrid (UCM) is the largest, since it has two different fields and consists of a large number of centers, facilities. For example, the MCU 26 has faculties.

The University of Jaume I was in second place by size. It has a total of 4 faculties and numerous facilities dedicated to research and sports. Buildings like the ESPAITEC, the library or sports facilities.

Finally, the University of Vic which has two smaller campus than the previous two universities, where are located the 4 faculties, the library, and some buildings for research. The difference with the UJI is that the University of Vic has fewer buildings than the UJI.

As mentioned, this aspect is not significant enough to determine if a university policy is higher or lower in terms of teaching and research activities. This aspect only influence in the existing of different facilities and centers, so it could be a relation between the existence of a higher number of facilities, and the activities of teaching and research.

2.4.2 Institutional aspects

The table below shows the budget allocated by the Ministry of Education for public universities in each of the regions where analyzed universities, are located.

TABLE 18. Budget of the Ministry of Education for public universities in Madrid, Catalonia and Valencia (2014)

Budget	2014
Madrid	1.493.097.180,00 €
Catalonia	1.297.896.181,00 €
Valencia	1.008.594.147,00 €

Source: Own elaboration through Education Ministry data.

It can be seen as it is in Madrid where the budget for public universities is higher. The Valencia region ranks last with a budget for public universities of 1.008.594.147 €. This aspect also largely determines the difference observed in the universities, since what each university receives individual is unknown.

To solve this problem, during the analysis of each of the budget of each of the universities studied was also assessed. The table below shows the budget for each of them in 2013.

TABLE 19. Universities Approved Budget for 2013

University	Budget
Universidad Complutense de Madrid	518.127.373,00 €
Universitat Jaume I (UJI)	91.528.000,00 €
Univeristat de Vic	33.528.323,00 €

Source: Own elaboration through the annual reports of the three universities

It can be seen how the UCM is the university with a bigger budget allocated to his activity, showing a great difference with the other two. This factor, as well as the size of universities, does not explain 100% that there are differences between teaching and research activities, and that this budget can be allocated to numerous causes or tasks. However, it is influential because as most budget have a university, more possibilities to allocate this budget in different teaching and researching tasks.

2.4.3 Comparisons in teaching activities

The table below shows the range of each of the three universities in degrees, masters and doctorates. This really is influential factor in determining the differences observed in the previous rankings, since the higher offer of securities, the greater the possibilities that universities can offer in terms of teaching.

It can be seen as the UCM is the largest offering degrees or other titles with a total of 308 titles between degrees, masters and doctorates. With 99 titles it ranks second UJI. Finally, there is the University of Vic with just 61 degrees offered.

TABLE 20. Degrees, masters and doctorates offers of the studied universities (2015)

Offer	UCM	UJI	UVIC
Degrees	81	31	33
Masters	169	49	16
Doctorates	58	19	12
TOTAL	308	99	61

Source: Own elaboration through the web pages of the universities

On the other hand, the services offered that somehow improve the quality of teaching on universities. As it can be seen in the study of each of them, all have adequate support services such as schools d teaching languages in summer training courses, libraries, so it cannot show major differences between universities as services offered. However, the facilities are better on the UCM, that on the other two universities. For this reason, the Complutense University of Madrid occupies better position in the rankings.

Finally, the table below shows the teaching and research staff of each of the universities. This is another factor to measure the quality and relevance of teaching, because a higher number of teachers and other investigators can facilitate the quality of the teaching activity and knowledge.

TABLE 21. Number of Teaching and Research Staff of the three Universities (2015)

University	Teaching and researching Staff
UCM	5873
UJI	1329
UVIC	748

Source: Own elaboration through the different web pages of the universities.

It can be seen as the UCM has the highest number of teaching and research staff with 5873 employees. In the last position the UVIC with only 748 employees. In this case, differences in the personal self that may explain the observed differences in the rankings of university teaching, as the staff determines the quality of teaching. A greater number of teachers, higher percentage of teachers per student increased supply of titles and quality of them...

With regard to teaching, the factors that explain the observed differences between universities studied in the rankings of paragraph 7, reside in the range of titles and number of teaching and research staff. In this case, the UCM would be the best of the three, followed by the UJI and finally the UVIC.

2.4.4 Comparisons of research and technological transfer activities

In this case, aspects related with research activities as research groups, technological institutes, centers or facilities to support research, research staff and research results (patents, publications ...) are compared. The goal determine the mainly factors that explain the differences on the rankings elaborated at point 2.3.

- **Research groups:** The first aspect to be analyzed is research groups. The table below shows the research groups having each of the three universities.

TABLE 22. Research groups at the UCM, the UJI and UVIC (2015)

University	Research Groups
UCM	600
UJI	165
UVIC	23

Source: Own elaboration trough the different web pages of the universities.

It can be seen as the UCM has the largest number of research groups, with a huge difference over the other two universities. Moreover, UVIC only has 23 research groups. In this case, one can say that the UCM is the university that more resources allocated to research activities having a large number of research groups.

- **Technological institutes:** Regarding to technology institutes, emphasize that the UCM has the highest number (38), the UJI is in second place with 11 institutes, and UVIC ranks last position with 9 schools or institutes.
- **Centers and support services to the research:** In this section noted that the three universities have centers or services to support the research work. For example, as it seen above the three have a body of research management that manages all the tasks of research and technology transfer. They also have technology transfer offices to handle all the paperwork and agreements with other entities, patent management, dissemination of knowledge ...

Therefore, the differences between universities do not reside in the existence of support services for the research, as all have, but the quality of those services. Under this view the UCM and the UJI are superior to UVIC since they have more services and funding programs of research activity on their campuses. The two have a science park in cooperation with other institutions to encourage this type of activities, programs have greater project financing... In short, the UCM and the UJI has a better structure

research management and transfer knowledge, allowing them to be better than UVIC. This situation is reflected in the rankings to show that both in the field of research and technological development in the UCM and the UJI are better.

- **Research Staff:** In this case, the differences between the three universities studied are more evident as the research staff varies according to the university. The table below shows the research staff of each of the universities analyzed.

TABLE 23. Universities Research Staff (2015)

University	Research Staff
UCM	500
UJI	1329 (PDI)
UVIC	204

Source: Own elaboration through the different web pages of the universities

In this case it's necessary to explain that the UJI staff corresponds to the entirety of the PDI, within 1329 is jointly teaching and research faculty because it's unable to calculate the exact number of researcher. In any case, the UCM only research staff and has 500 professionals, so it is the university that has more staff in these activities. UVIC is characterized by having only 204 researchers. For this reason, in the rankings of research, UCM listed first followed by the UJI and UVIC. The staff has greater investigative leads having more operational projects, research groups, research centers...

- **Budgets for research activities:** This is very important because it is what allows performing various research and technological development. In this case, significant differences were also observed.
The UJI is the university with its own funds, more financial resources contributes to research (€ 7,444,843). UVIC is in second place with funds contributing the amount of € 3,493,094 for research activities. Finally, UVIC is less equity to contribute to research activities. For example, research groups intended only € 7,500.
However, this budget is usually backed by other public and private institutions using financial resources to support research projects at universities. In this case, the UCM is what ultimately gets bigger budget to finance research activities (€ 49,232,974). The UCM is repositioned as the best regarding the budget for research activities and technological development.

- **Main research results:** The table below shows the portfolio of patents owned by the UCM and the UJI. UVIC has not been able to locate information about its portfolio of patents or patent applications made, for what it seems like they do not have any.

TABLE 24. Patent Portfolio UCM and UJI

University	Patent Portfolio
UCM	290
UJI	7

Source: Own elaboration through the different web pages of the universities

It can be seen as the results (as the number of patents) are much higher in the UCM in the UJI. This result reflects the difference and that has been discussed throughout this section in the practices followed, research centers, research groups ..., between the UCM and the other two universities. Result is also reflected in the number of publications in journals, research articles...

As it mentioned, the UCM has more than 200,000 items in your library, of which 32,000 are published in journals of different scope. The UJI, meanwhile, has a total of 2694 publications by departments and published in different journals and documents have 5231 as a result of his scientific production. Finally, UVIC offers a total of 966 publications in journals, about 30 scientific papers and 36 doctoral theses.

Throughout all this comparison, it can be seen how the UCM is the university with more offer of titles, the one that has more investigators and teachers, the university with higher and numerous facilities has to improve both tasks (teaching and researching tasks)... All these aspects are the result of the UCM possesses greater results both patents and publications ... All these results reflect the UCM University the most competitive of the three, as showed the rankings at point 2.2.

2.5 Conclusions

The aim of this research is analyzed the possible impact that the combination of exploration and exploitation activities produces on the level of universities competitiveness. The conclusions are the following:

First, the importance of the resources and capabilities of the company in obtaining a competitive advantage. The study of the three universities, attempts to analyze than those that use more resources and capabilities in their activities, are ones that the best

competitive position occupy. For example, when analyzing each of the universities, it can be seen as the UCM, with the best competitive position, is the one that more resources and capabilities allocates in their activities. Therefore, we can say that the use of resources and capacities on the activities of any organization can have a positive impact on the competitiveness of these.

Second, the importance in recent years of the tasks of exploitation and exploration to obtain a competitive advantage. In the case of the three universities analyzed, it can be seen how each of them have made efforts to exploration and exploitation. For example, the three analyzed universities have facilities to promote both their traditional activity (teaching and research) and the development of new activities aimed at the commercialization of knowledge through services that encourage collaboration with other institutions, platforms for publication of documents, patent creation.

In this regard, the importance of combining these tasks (exploration and exploitation). In analyzing the three universities, it can be seen as all attempt to combine these two types of activities through institutions and services, with the objective of generate knowledge, but also transfer this knowledge. For example, in the analysis it can be seen as each university has research groups and other services to generate knowledge, but it also exists other institutions and services with the aim of transfer this knowledge. In this sense, the analyzed universities consider both types, exploration and exploitation activities.

In relation to the objective of this work, the analysis has been prepared considering that the operating activities are those associated with traditional practices of universities, such as teaching and research. Furthermore, exploration tasks have been linked to the innovative practices developed by the universities, with the aim of knowledge transfer and commercialization, such as collaboration with other institutions, publications of articles, creations of patents. In this sense, during the part of the analysis are linked by this criterion all the activities developed by the three universities.

The study on universities also aim to strengthen the factors explained in the theory (the size of the university, institutional aspects, teaching and research activities), and who are influential in the development of exploration and exploitation, and therefore for competitive advantage. All of these factors are important, but also it's common to observe universities with lower size and support, developing his level of exploration and exploitation activities. In this sense, it should be observed that the size of the universities and the support are factors that can influence the level of exploration and

exploitation, but not with a direct impact. There are a lot of studies related with the impact of these two factors, therefore, it should be analyzed in future researches.

The other factors, teaching and research, it does have a direct connection with the exploration and exploitation. In this case, improvements in these two areas of activity, also involve promoting improvements in exploration and exploitation, and therefore in improved competitive advantage. For example, you can see how the UCM, which is the most developed university in teaching and research tasks, occupies the best competitive position.

With the above, this study aims to analyze the impact of the combination of exploration and exploitation on the competition between the universities. In this sense, defends the idea that there is a positive impact on the use of exploration and exploitation, and the competitive position of universities. For example, the analysis show this idea since it can be seen how the UCM that is the university that most exploration and exploitation has, and also it's the one with a better competitive position in relation to the other two.

This study remarks the importance for universities to combine these two types of activities, and not just focus on one of them. Universities would be advisable to encourage this combination and guiding the organization both to its traditional activity such as teaching and research (operating activity), with more novel tasks such as transfer and collaboration with other institutions (exploration).

Finally, note that the main limitation of this study has resided in the calculation of the budgets obtained by each university and the specific budgets for each of the activities (exploration and production). In this regard, notes that in the case of some universities, this kind of information is private and not accessible to any user. Moreover future studies should analyze the causality between the variables analyzed through data of a wide range of universities and in a wider period of time.

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