



I2Tech- **CAMPUS MONTEGANCEDO**
Universidad Politécnica de Madrid



POLITÉCNICA
"Ingeniamos el futuro"

**CAMPUS
DE EXCELENCIA
INTERNACIONAL**

Evolution of the strategic objectives and activities of the International UPM's International Campus of Excellence at Montegancedo

Progress report

2010-2013

September 2013



PROGRESS REPORT

“MONTEGANCEDO CAMPUS: ICE oriented towards international technological innovation I2 Tech”

Period: 2010-2013

Project data: MONTEGANCEDO CAMPUS: ICE oriented towards international technological innovation I2Tech

Type of ICE: Global Regional

Acronym: I2 Tech **Montegancedo Campus**

Coordinator: **UNIVERSIDAD POLITÉCNICA DE MADRID (UPM)**

Universities participating in the aggregation: **UPM**

Other entities promoting ICE: **No**

Periodic report: 1º (2012) 2º (2013) 3º (2014) 4º (2015)

Period: **2010-2013**

Name of coordinators in the promoting institutions:

Gonzalo León (UPM)

Tel: **+34 91 336 6047**

Fax:

e-mail: **secretaria.vinvestigacion@upm.es**

Web page of the Project: <http://www.upm.es/Montegancedo>

Contents

1. Evolution of the objectives of the ICE Montegancedo.....	4
1.1. Ratification of objectives.....	4
1.2. The role played by the Montegancedo International Campus of Excellence in a technological university	9
2. Evolution of the main results obtained to date	18
3. Strategic decisions in the evolution of ICE Montegancedo	28
4. Physical development and research capacities of the Campus	32
4.1. Construction of new buildings for R&D&I.....	32
4.2. Acquisition of scientific equipment.....	36
5. Evolution of the ICE in the exploitation of results	45
6. Improving the services at the Montegancedo ICE	58
7. Evolution of the internationalization process of the Campus.....	63
7.1. Levels and strategy for the internationalization of the Campus.....	63
7.2. Strategic alliances promoted from the Montegancedo ICE.....	64
7.3. Internationalisation of students and projects of the ICE Montegancedo	67
8. Consolidation of the relationships with the aggregations	68
9. Policy for human resources and advanced training.....	71
9.1. Human Resources for Research	72
9.2. Adaptation to the European Higher Education Area	73
9.3. Promotion of the Masters' and PhD Degree programs	75
9.4. Training in Entrepreneurship	77
10. Interaction between the Campus and territorial environment	78
11. Envisaged future evolution	84
12. Conclusions.....	89
Annexe 1: Summary of key indicators for the Montegancedo ICE	96
Annexe 2: Key associated documentation	98
Annexe 3: Aggregations	99
Annexe 4: List of acronyms	100

1. Evolution of the objectives of the ICE Montegancedo

1.1. Ratification of objectives

The I2_Tech proposal presented by the UPM in 2009 to the open call for the International Campus of Excellence (ICE) published by the Ministry of Education and resented in 2010 as an updated proposal has not lost its relevance as the strategic basis for the integral development of the **International Campus of Excellence at Montegancedo**.

The need to reaffirm the essential objective proposed since the preparation of the Project proposal: to increase the **support to technological innovation jointly with the business sector**, by using information and communication technologies (ICT) as a backbone and catalysing element through the empowering of the research activity, became a fundamental axis of the UPM's activity as presented in other documents related to the ICE Montegancedo¹.

This strategic objective should be sustained in the continuous improvement in the quality and quantity of the research activity and its international impact. The UPM is committed to developing a *science-driven innovation* approach to support disruptive technology innovation which the University is well prepared for. From the vision of the UPM, it would be not possible to strengthen its innovation role in society without the capability of putting very innovative technological ideas on the market based on its research activity which should be fully integrated into the value chain of products and services.

This vision is complemented with the need to complement the UPM's academic effort with an entrepreneurial attitude in all of its students both in undergraduate and postgraduate courses. This vision should impact the entire educational range of the university in addition to setting up specific courses or seminars on entrepreneurship.

The **ICE at Montegancedo** is a key element of this strategy to become an open innovation ecosystem in itself where the UPM and other "aggregated entities" ("allies" in the ICE programme terminology) jointly generate value through the combination of teaching, research and innovation activities as presented later in this report.

As an overall evaluation of the **effort carried out on the protection and exploitation of the scientific and technological knowledge generated**, the UPM is at the vanguard of Spanish universities with figures similar to those found in other European universities (with the

¹ See the document on "Objectives and Structure of the Support Centre for Technology Innovation" presented to the Governing Committee of the UPM in 2012 and the documentation generated on the occasion of the visit from the Ministry of Education, Culture and Sport in May 2013 "Report on the situation at the ICE at Montegancedo".

exception of some of them in the Anglo-Saxon context)² in relation to patents, technology licenses, or in the creation of technology-based businesses. Its privileged relationships with the business sector, consolidated over years in the number of contract-research projects and focused on the ICE Montegancedo with a large number of “aggregations”³ with private entities, also reflect the UPM’s commitment to making its generic objective of becoming a **strategic business partner to accelerate the innovation process** a reality.

As a consequence, it will be more common to find in both university research groups and the internal support policies a positive consideration of the effort in **fundamental research** (historically linked to the role of all public universities) and in **collaborative research** with other entities (emphasized in technological universities) linked to a growing awareness of the use and exploitation of the results obtained in the global technological market.

The “iceberg” image used here as a metaphor (see figure 1) shows, however, that the visible part of the university activity to be transferred to society through the exploitation of results relies, precisely, on the existence of a hidden research activity which could emerge from layers more or less closer to the surface if it were properly detected and supported. This is the vision to be developed at the ICE Montegancedo: **to be able to bring that activity to the surface in a context of open innovation.**

The cultural change implicitly associated to this vision is taking place in the university world: in fact, it is becoming more common to find some references in the institutional message of Spanish universities to those internal activities or programmes focused on an improvement in their performance from the perspective of the support to technology innovation. This process is implemented through several types of institutional activity and favouring the impact of their efforts on society.

² During the period 2010-2012 the UPM has coordinated a research project funded by the EU FP7 (with Oxford University, Politecnico di Torino, Technological University of Munich and Paris Tech) called **ULAB** (University Lab) (see <http://www.ulab-fp7.eu/> for further information). Its objective was to analyze trends in the exploitation of results, technology-based creation, R&D structures and knowledge diffusion in several European technological universities. The UPM’s leadership in some of these actions is an example of the large institutional role assumed.

³ We use the term “aggregation” as defined in the ICE Programme by the Ministry. The concept implies a strategic alliance between the university leading the Campus and another entity.

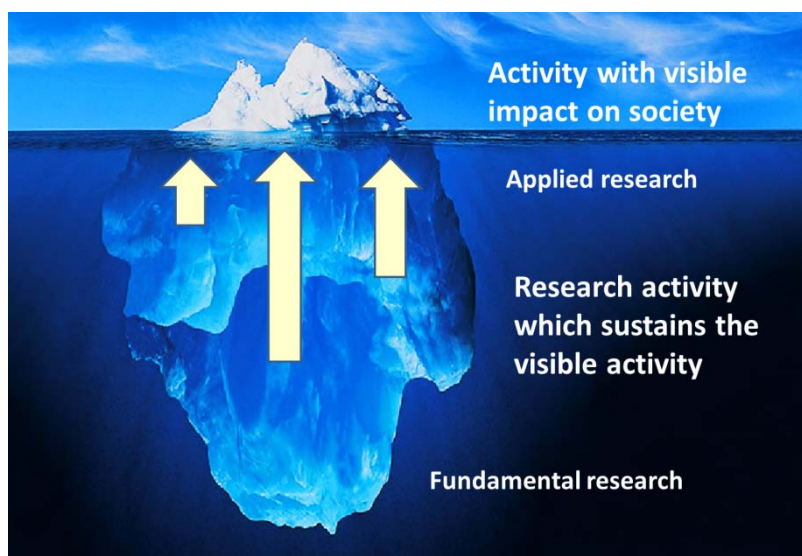


Figure 1. The iceberg of university activity

This **report** corresponding to 2013 (the previous report was dated in September 2012) is not limited however to the activities exclusively carried out until August 2013. On the contrary, it makes an **overall evaluation of the development of the Montegancedo Campus** since, in many cases, the 2013 activities complement or fully develop some of the activities initiated in previous years. We consider that, in this way, it is possible to obtain an overall view of the evolution of the ICE Montegancedo which is not possible just by using a temporal vision limited to 20123.

The status of the current development of the completion of the **objectives for the International Campus of Excellence** as its recognition by the Ministry of Education, Culture and Sport (MECD) is specified in the following priority objectives:

- To progress in the implementation of the schedules funded by the resources obtained from different open calls supporting ICEs.

As some of the funded actions have not yet finished, their results cannot be presented; it is much more difficult to value the *“impact assessment”* of all of them in the modernization process of the university.

The UPM is well aware that due to the lack of new funding calls issued by the General Administration of the Spanish Government (AGE) in 2013 to support ICEs, together with the lack of calls to purchase scientific infrastructures by the *Comunidad de Madrid* (Madrid Regional Government), there are no additional AGE resources for the construction or acquisition of new scientific infrastructures for the next few years. This

situation has forced the UPM to increase its agreements with strategic partners in the private sector in order to make up for the great reduction in public resources.

- To increase the economic resources obtained through R&D and innovation activities through specific agreements signed by the UPM with several actors.

The UPM, in the context of the development of the Montegancedo Campus is carrying out multiple negotiations (some of them finished while others are still in progress) related to different research centres located in the Campus (CITA-IDR, E-USOC, CBGP, CEDINT, CTB, CBGP, COM, IMDEA Software), the *ETSI Informáticos* (School of Computer Engineering)⁴, and support centres for R&D and innovation (CESVIMA and CAIT) with the goal of increasing their future sustainability and growth.

The excellent participation of the UPM in the FP7 of the EU (and the positive expectations in the context of the future H2020) can be assessed by the fact that the Montegancedo Campus currently absorbs 30% of the total participation of the UPM in the FP7; this percentage has risen to 45% of the UPM in the field of Information and Communications Technologies. We are convinced that this process will be extended in the near future to the participation in other international R&D programmes such as the European Space Agency (ESA).

- To increase the location of new scientific and technological facilities, spin-offs and start-ups, and joint labs with the business sector.

The goal is to promote the joint development and future commercialization of technologies and technology-based solutions through long-term agreements. These activities will increase the capacity of the Campus to attract new researchers to strengthen cooperation with the industrial sector by simultaneously supporting the generation of innovative “industrial tissue”.

This goal is especially relevant for the UPM because of the potential capacity of the University in applied technology and knowledge commercialization generated in its centres. The recent creation of a specific unit in the new “*Centro de Apoyo a la Innovación Tecnológica*” (Support Centre for Technology Innovation) which focuses on

⁴ The **Facultad de Informática** officially changed its name in June 2013 to the **Escuela Técnica Superior de Ingenieros Informáticos** (ETSI Informáticos) which will be the name used in this Report. Note that previous documents referring to the ICE Montegancedo use the previous name of the Faculty.

the maturation process of promising technologies opens up new possibilities which must be dealt with in an effective way during the coming months.

- To promote the range of postgraduate education in the Campus both through formal courses and continuous education.

The aim of this strategy is to work simultaneously in the following three axes in order to increase the number of postgraduate students in the Campus and to facilitate their participation in research groups:

- Official Masters' and PhD Degree Programmes organised and imparted by the ETSI Informáticos.
- Official Masters' Degree Programmes organised and imparted by the research centres, as well as other UPM Masters' Degree Programmes which are partly delivered at the ICE Montegancedo through agreements with a number of departments of the Engineering Schools of the UPM.
- Custom-designed courses with and for the industrial sector taking advantage of the facilities located in the Campus.

This process will additionally increase the number of non-Spanish students after extending the range of academic courses outside the local context of the UPM; the goal of this strategy is to accelerate the internationalization process of the Montegancedo Campus.

After reviewing **the adoption of strategic decisions** in different perspectives oriented towards the objectives presented above, this Progress Report will address the envisaged of the Campus until December 2015 which is year in which the I2_Tech project is scheduled to finish. The Progress Report is complemented by a set of annexes which offer complementary information (summaries of activities and data).

Furthermore, the documents associated to the Progress Report include the updated fact-sheets for each of the funding activities. Furthermore, a "2020 vision" article on the Montegancedo Campus will offer, from a more personal view of the Delegate of the Rector the potential role to be played by the Montegancedo Campus for the UPM in the national and international context has been also added.

1.2. The role played by the Montegancedo International Campus of Excellence in a technological university

From the UPM perspective, the **role of a technological university in society** must be framed in an integrated perspective anchored in the three axes of the so called “**knowledge triangle**”, as detailed in figure 2, in close interaction with fundamental actors of the innovation systems: the research centres owned by public administrations (AAPP) as the “*organismos públicos de investigación*” (OPIs) (public research entities) or the research centres created and supported by the *Comunidades Autónomas* (CCAA) (Spanish Regional Governments), and the business sector (including both business and technology centres)⁵.

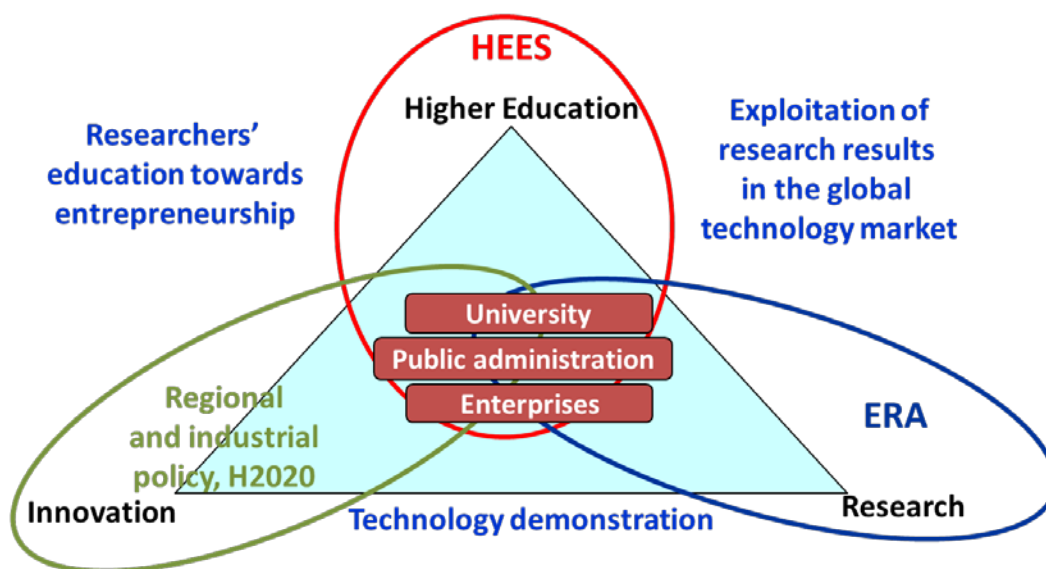


Figure 2. The University in the context of the knowledge triangle

The desirable evolution of Spanish public universities in the national innovation system is less evident from the analysis of the **composition of their annual budgets**; specifically, in the way that block-funding from public administrations is allocated to individual universities. In the current Spanish situation, both aspects are still focused mainly on supporting the educational activity.

Furthermore, the university structures focused on the exploitation of results (these activities are usually linked to the Technology Transfer Offices (*Oficinas de Transferencia de Resultados de Investigación*, OTRI) could not be fully included in the institutional architecture of public universities. In many cases, these units were kept apart from the institutional decision making

⁵ The conceptual scheme chosen in the development of CEI Montegancedo does not correspond with the so-called “triple helix” model in which public administrations play a key role as funders or facilitators of framework policies. That role is considered in this Report as meta-contextual (a good example is the Excellence Program) and it will not be explicitly addressed.

structures at the core of the universities (involving, for instance, foundations supported by specific programmes funded by public administrations) with a lack of staff qualified in commercialisation fields together with the very poor involvement of permanent staff.

In short, in spite of the growing recognition coming from public administrations and universities themselves as mentioned above, **the results deriving from the exploitation of research results in economic terms to bring about a deep structural reform in universities are still very poor**. These internal structures of universities have rarely obtained the economic resources and the stability to promote the necessary change of mentality in the University as a whole to accelerate its modernization process.

Then, there is a feeling, shared by the most European university communities (and Spain is no exception) that **innovation support activities are secondary elements of the social mission of universities**. Therefore, these activities have a relatively low weight in university life. As a consequence, when implemented, they are usually **far from the core institutional decision structures** in comparison to the socially recognised missions such as the education of professionals and the generation of scientific knowledge.

Figure 2 also shows that the positioning of universities was made in the European Union (EU) hand in hand with the creation of two policy common spaces: the **Higher Education European Space (HEES)**, completed in its fundamental goals, and the **European Research Space (ERA)** still in process. The growing importance paid to the innovation perspective by the European Union (EU), both from the regional policy and in the **Horizon 2020 proposal (H2020)** in its final phases of negotiation, will signal a change of direction in the EU for the period 2014-2020. Both programmes will favour activities such as the development of technology demonstrators or the education of researchers emphasizing entrepreneurship. The envisaged interaction between these two “spaces” (proposed since the London Declaration of European Ministries of Education) and the joint support that both frameworks paid to the “entrepreneur vision of the European University” has given rise to a change-of-cycle in the social role of the University.

The UPM, specifically in the development of the **International Campus of Excellence of Montegancedo**, would like to break the fragmented vision of the university action to emphasise the institutional objective of increasing its “**excellence in innovation**” and, specifically, elevating technological innovation to the **identity** of the UPM.

Figure 3 reinforces this idea by supporting the implementation of a **university strategy towards excellence in innovation**. This is pursued through a set of coherent actions in the

education and research axes represented in figure 2. Then, the creation of new enterprises, the commercialization of results, the marketing of technology or the active promotion of solutions, the carrying out of analyses and technology watch studies, etc., constitute complementary tools with higher relevance as we uncover the underwater university knowledge by using the aforementioned *iceberg metaphor* presented in this Report.



Figure 3. Innovation support areas in public universities

To make this vision feasible it is necessary to possess research results with the quality and global technology market orientation suitable for commercialisation. This is not possible if the research activity is not carried out in units with the sufficient critical mass to address the development of disruptive technologies and to be able to devote efforts necessary to bring about its maturation. For this reason, the ICE Montegancedo has promoted the **creation of new research centres** and, if possible, from an **open innovation** perspective with other public and private actors to obtain the necessary critical mass.

Although it is still very premature to make an evaluation on the synergic effect from the activity in the three axes of the knowledge triangle, preliminary data obtained by the UPM indicate, however, a **quantitative and qualitative improvement deriving from this integrated vision**. Three factors are essential for this:

- A sustained **institutional vision on the role corresponding to a technological university** with respect to the exploitation of research results, in close cooperation with the research activity developed by the research groups at our research centres and institutes.
- The **experience in commercialisation of knowledge and technologies**, although limited, transferable to the business sector, which has been institutionally supported

in the last two years. It has generated a series of businesses and aggregated entities resulting in a fruitful interaction over time.

- Funding received from the International **Campus of Excellence of Montegancedo** (and, previously, from the open calls for Scientific and Technological Parks). These resources have accelerated the support to innovation with specific actions at a moment in which the economic crisis has made it difficult to dedicate resources for investments from university budgets⁶.

The strategic development planning of the Montegancedo Campus as a campus **“oriented towards technology innovation”** by emphasising the use of **information and communications technology (ICT)** has focused on cooperation with private entities (although there are also some research centres and labs jointly created with other PROs and universities) constitutes a new and exciting field of activity in the national panorama. This approach is closely linked to the shared vision on the role to be played by the UPM with these entities to make the model based on the creation of a **university-driven open innovation ecosystem**, as it is the case of the UPM, a reality.

Figure 4 details how the UPM combines the **academic valuation** of the results from research projects (usually through scientific publications but also by putting these results at the disposal of scientific communities as freely accessible software packages or databases) with a potentially marketable commercial valuation of these results.

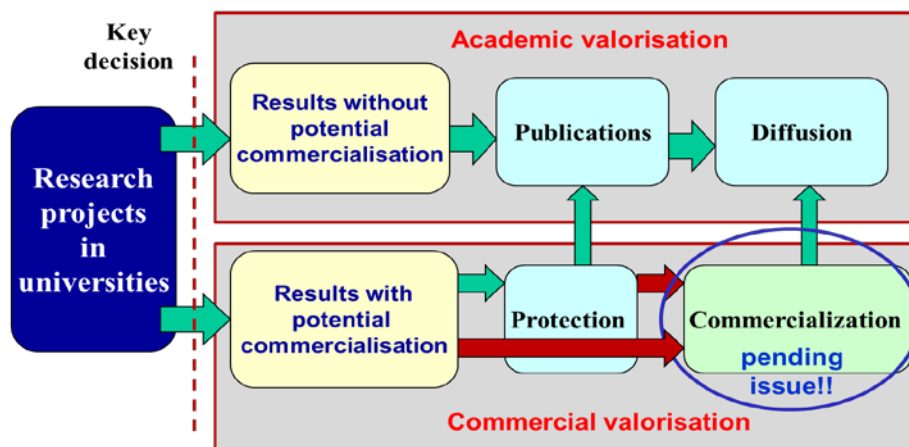


Figure 4. Efforts in the commercial valorisation of results

As stated in figure 4, the commercialization effort conducted from a strategic institutional point of view is still a pending issue in the majority of European public universities. ICE

⁶ In the specific case of ICE Montegancedo funding provided by the “Comunidad de Madrid” for the construction and operation of the IMDEA Software located in the Campus was also available.

Montegancedo explicitly wishes to explore several models for that and to advance it by **creating specific innovation support structures** (servicing the whole UPM and not only ICE Montegancedo).

The efforts made in the **“protection of research results”** by Spanish universities during the last decade have been very positive as indicated in the reports issued by the OTRI network or other entities; both in the number of patents and the international extensions of some of them; unfortunately, this evolution does not correlate well with the effective exploitation of these intellectual assets.

Many of the patents simply improve the personal *curriculum vitae* of inventors rather than a sound strategy for their exploitation aligned with university approach as owner of these patents. It has not been of institutional interest to the UPM, who has implemented a profound change in its institutional strategy in order to face the costs derived from the maintenance of its patent portfolio, to link it to the actual possibilities for commercialization⁷.

During the development process of the ICE Montegancedo, the activities carried out have been conceived under an integrated vision within the aforementioned knowledge **triangle model**. For this reason, research, innovation and higher postgraduate education were conceived from an integrated point of view; the **innovation perspective** plays a “cohesion role” with other public and private entities in the Campus.

It should be taken into account that, after the modification of the UPM Statutes, in 2010, the R&D centres and the university research institutes were also able to become academic organisers for postgraduate Masters’ and PhD Degree Programmes (without professional attributions in accordance with Spanish Law) and, after agreements reached with departments, the schools and faculties, carried out some of the teaching activities of other under-graduate or post-graduate programmes. This modification reinforces the integrated character of the UPM structures by preserving its fundamental role⁸.

⁷ Note that the UPM regulations have set out a scheme for the distribution of royalties where inventors would receive 50% of the incomes derived from the exploitation of their invention.

⁸ An example of the relationship in the aforementioned direction is the approval by the UPM of new degree curricula in **Biotechnology** and **Biomedical Engineering** where the implementation is associated, respectively, to the ETSI Agrónomos and ETSI Telecomunicación. Their development will take into account the use of very specialized research infrastructures available in the **CBGP** (Biotecnología y Genómica de Plantas) and **CTB** (Tecnología Biomédica) research centres located in the Campus de Montegancedo. The implementation of the Spanish node of the KIC ICT-Labs will also provide the opportunity for the consolidation of activities linked to entrepreneurship between IMDEA Software, CAIT and ETSI Informáticos.

In figure 5 it is possible to see schematically the “units” available at the ICE Montegancedo in September 2013 and their main relationship with one of the perspectives of the aforementioned **knowledge triangle**⁹. Many of them, as detailed in figure 5 have been created or they are working in close cooperation with the business sector (or even in joint ventures with companies in order to offer a specific service).

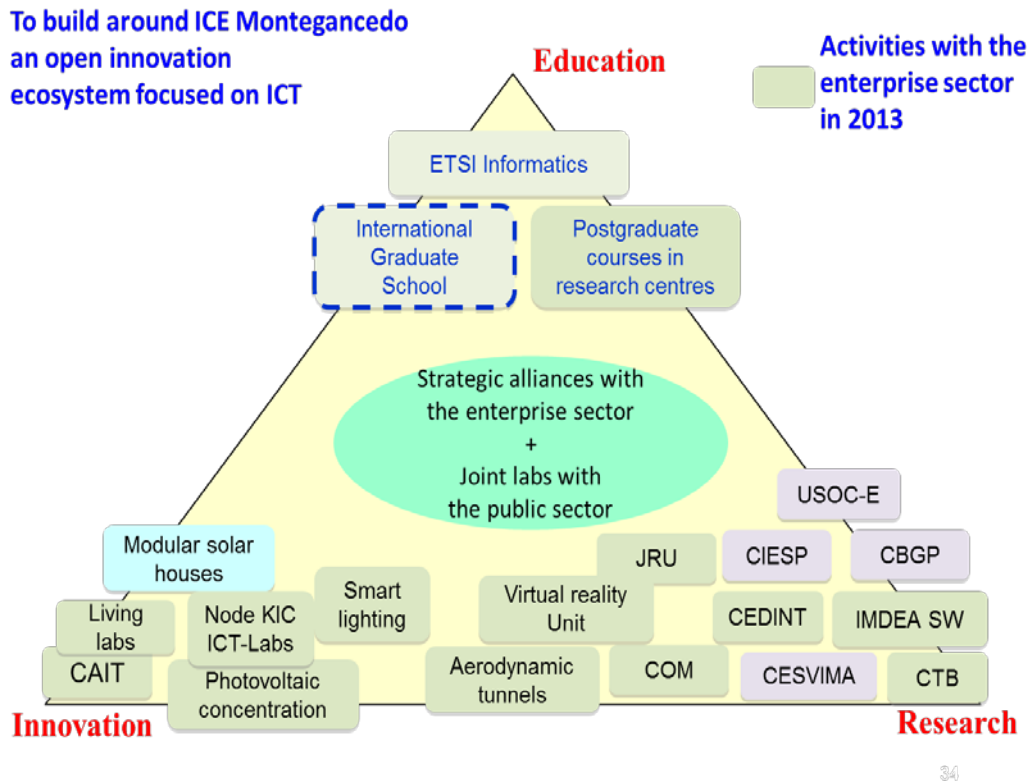
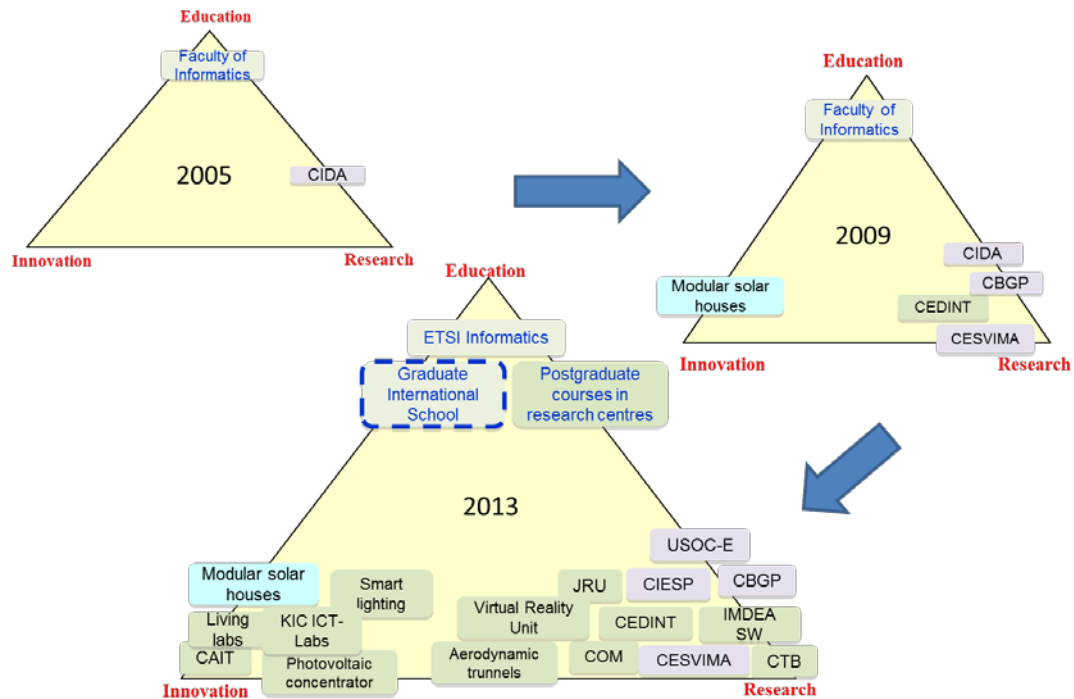


Figure 5. Units created at the ICE Montegancedo from the perspective of their main function in the knowledge triangle (situation in September 2013)

This situation has been reached in a very short period of time. Figure 6 helps in visualising the dramatic transformation that has taken place in the Montegancedo Campus since 2005 in three different phases. To this situation it is worth mentioning that the UPM was using the resources available for the Scientific and Technology Park on this site **in a coordinated way**, and later on the resources from the calls of the International Campus of excellence became essential. Both sources of funding were using in a complementary way, by serving the same overall objectives but adapting their use to the specificities of each call.

⁹ In some cases, they also carry out activities on other perspectives but, by simplicity in the scheme, they are only located in one perspective of the knowledge triangle.

Evolution of strategic objectives of ICE Montegancedo



35

Figure 6. Evolution of the Montegancedo Campus over time

In summary, the official ministerial recognition of Montegancedo as an International Campus of Excellence has allowed the acceleration of its development process in a geographical context near Madrid within a privileged natural environment (see the two aerial photographs in figure 7).



Figure 7. Partial aerial views of the ICE Montegancedo

The institutional objective of the UPM for the **ICE Montegancedo**, as will be presented in detail later on, corresponds to a vision, supported by the institution, **anchored in the cohesion role of the innovation activity at the UPM** by reinforcing the rest of perspectives of the university activity without compromising their own objectives. On the other hand, this vision improves

their volume and quality by shortening the time required to achieve an international relevance and opening doors to a greater number of agreements with third-party entities.

Likewise, in the period since the positive recognition was obtained by the Campus, **the objective of strengthening the relationships with the aggregations** has been achieved in its entirety. It is true that with some of them, the advance has been very relevant to the creation of joint technology centres, and in other cases much slower; however, the general evolution is very positive.

It should be also noted that the recent inclusion in this period of **additional private entities** such as ICE aggregations reinforces the relationship with the launching of new projects. It has made the creation of an **open innovation ecosystem** around the intensive use of the ICT whose generic lines will be presented later on in this Report a reality.

Finally, especially since 2013, a number of actions to increase the international visibility of the Campus have been achieved through the organisation of **international conferences or workshops** linked to different R&D centres located in the Campus (these activities will be commented on in a later section). This activity has attracted hundreds of national and international researchers and it has conferred an international character on the ICE Montegancedo. The effort made in facilitating information on the Campus and the redesign of the Web page has also contributed to this objective with the aim of obtaining greater interactivity as well as including additional information for those interested in getting to know the activities taking place on the Campus.

Figure 8 sets out the overall idea on the **physical development of the Campus Montegancedo** (on the Campus web page you can see several aerial images of the buildings)¹⁰. The current economic crisis and the substantial reduction in public funds for Spanish universities have affected the future development plans initially considered by the UPM in relation to the Montegancedo Campus; however, it should be noted that, in spite of this situation, the UPM has not stopped any activity once started¹¹.

¹⁰ ICE Montegancedo is located on a site of 480,000 m² owned by the UPM where it is possible to build around 50,000 m² so as to launch new actions in the future.

¹¹ This institutional will of continuing the initial planning process for the Campus has allowed the conclusion of the majority of the planned actions. The only relevant activity that has been postponed is the construction of the student, researcher and faculty members' residence; however, its physical development will resume when the economic situation improves in Spain.



Figure 8. General view of ICE Montegancedo

The effort made until now has consolidated the generation of an open innovation ecosystem driven by the UPM with the participation of other entities. Figure 9 corresponds to the **conceptual vision of the ecosystem** around the ICE Montegancedo. The figure shows how the UPM is establishing a set of relationships with different goals and intensities with their aggregations (and also with spin-offs and start-ups located on the Campus) in order to address **a number of objectives in the national and international context:**

- Linked to knowledge creation in order to address industry-proposed challenges (such as alliances with Santander, ISBAN, PRODUBAN, Repsol, etc.)
- Linked to the implementation of cooperative R&D projects through the creation of joint research units (case of Elekta, Telefónica, T-systems, LPI, Santander, INIA, CSIC, URJC, UCM, Instituto IMDEA Software, etc.)
- Linked to education or technology/knowledge transfer activities (case of INDRA, Plant Reponse, Accenture, Zeiss, BCG, UCB, etc.).

In some cases, as suggested in figure 9, these bilateral relationships have also promoted, other interactions between the existing entities located in the ICE Montegancedo.

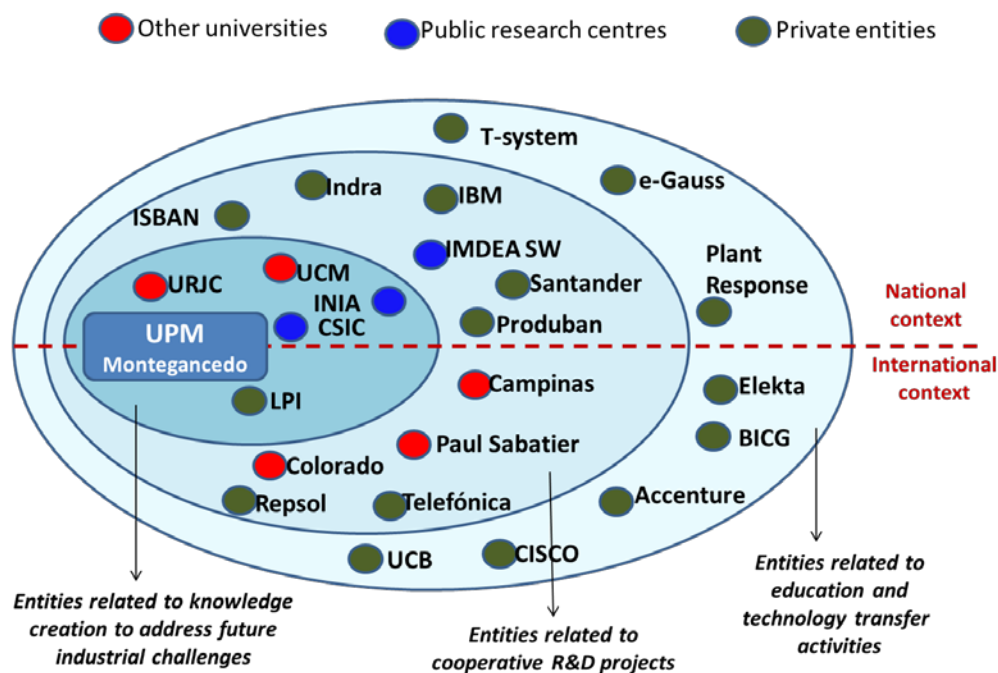


Figure 9. Conceptual scheme of the open innovation ecosystem of the ICE Montegancedo

The present situation of the activities related to the development of this ecosystem will be detailed in the Report although their evolution will continue during the next few years.

2. Evolution of the main results obtained to date

The assessment of the overall approach of the ICE Montegancedo presented in the previous section should be made after analysing the quantitative improvement obtained by the UPM from a set of basic indicators¹².

Since the Montegancedo Campus obtained the official recognition of the as an International Campus of Excellence in 2010, the UPM has kept the economic investments effort as planned and today that figure is over **120 M€**. The investments in physical infrastructures and scientific and technological equipment purchased since 2005 are included in that figure, regardless of whether the source of funding came from the support calls for Scientific and Technological Parks or those from the of Campus of Excellence Programme from the *Comunidad de Madrid*, and joint investments with aggregations.

The **qualitative evaluation of the economic effort** for the UPM associated to this volume of investment should be analysed from two fundamental facts: 1) the reduction in the block funding from the *Comunidad de Madrid* to the UPM (€38M less in the last two years), and 2)

¹² Annex 2 to this Report presents the advances of results in the selected indicators in detailed format.

the sharp reduction in the available resources in the public calls from the “*Administración General del Estado (AGE)*” (the publication of the open calls of 2013 was still pending in August 2013). This situation has given rise to the need to pay special attention to the obtaining of economic resources from the business sector; a goal for which the Montegancedo Campus is well prepared.

The relative importance of ICE Montegancedo in the overall performance of the UPM is assessed in figure 10; it can be noted how the resources obtained by the research centres located in the Campus have dramatically increased. In the last year covered by the figure (2011), these research centres count for more than **25% of the total activity of the UPM** for the majority of these indicators (and in some of them near 50%).

In other words, **data shows a shift of the research activity of the UPM towards research centres and institutes** as by increasing their contribution to the UPM as a whole in the strategic direction followed by the UPM since 2006.

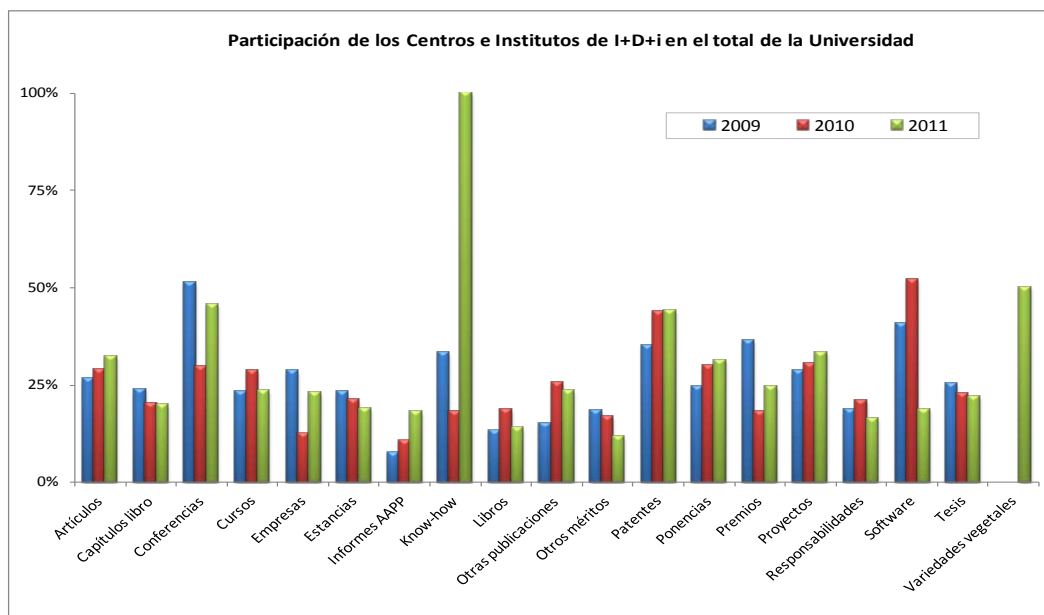


Figure 10. The evolution of income from research centres in 2009-2011

An example of the institutional commitment accepted by the UPM can be described by analysing the resources (mainly loans) obtained in the calls of the International Campus of Excellence in several open calls published by the Ministry of Education, Culture and Sports, and others from the Ministry of Economy and Competitiveness (and their former denominations). Figure 11 shows the temporal evolution of the commitments from loans with the “*Administración General del Estado (AGE)*” in the two cases of International Campus of Excellence with the participation of the UPM: ICE Moncloa and ICE Montegancedo.

Evolution of strategic objectives of ICE Montegancedo

The economic volume and calendar for the repayment of the loans changes over the years (see figure 11). In the case of ICE Montegancedo the UPM has received a total of **€9,800,000**; annual repayment fluctuates between €333,333.33 in 2013, to €876,939.90 between 2014 and 2024 (inclusive) and €543,606.57 in 2025.

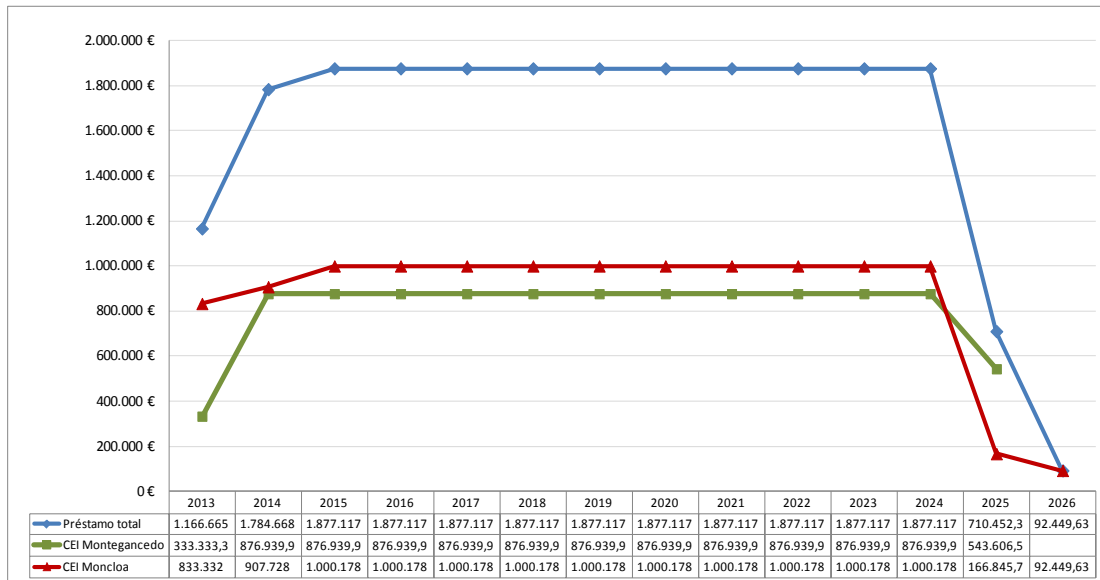


Figure 11. Loans obtained and repayment commitments in ICE Montegancedo and ICE Moncloa (Source: Vice-Rectorate for Research, UPM)

Figure 11 also shows the political consequences in the year 2014 where there will be a dramatic increase in the volume of the amount to be repaid from the resources obtained from the calls of the Programme of International Campus of Excellence. The UPM should be ready to make a collective effort to increase the income from those research centres which received the loans in order to fulfil one of the most important goals: to ensure the **role of the investments made as catalyser to obtain higher and better research activity and to increase the obtaining of external resources.**

To complement the amounts shown in figure 11 it is necessary to add those corresponding to loans obtained for the construction of some buildings with the resources obtained by the UPM in the calls to support scientific and technological parks. More specifically, these resources in the Montegancedo Campus were used to build and purchase scientific equipment for the Centre of Biotechnology and Plant Genomics (CBGP), the building in which the Centre for Smart Home Technology (CEDINT) and the Centre for Supercomputing and Visualization (CESVIMA) is located, together with the building of the Centre for Biomedical Technology (CTB) and the Centre for “Open Middleware” (COM); all of them using the “*Fundación General de la UPM*” (General Foundation of the UPM) a management and promoting entity of the UPM S&T

(Science and Technology) Park. The cases of the Research Centre for Aerospace Technologies (CITA) and the Business Centre (both buildings built with grants) will not be considered in this section. Furthermore, the enlargement of the Business Centre to locate the CAIT and the CIESP (in both cases by using loans) will not be considered here because the building was finished in April 2013.

Some of the investments made by the UPM also involve increases in recurring expenses derived from the new activity (security, cleaning, and utilities (electricity, gas and water) to mention but a few); although some of them will be theoretically lower in the original engineering schools or departments where the research groups which originated them came from. Furthermore, the research activity that is made available in the new premises generates additional incomes and, in many cases, is the basis for accessing competitive funds which would not be possible without them.

Figure 12 details this evolution of the research centers and institutes located in Montegancedo; note that in the year 2012 they obtained over **€12 M, six times the resources obtained in 2006**. This data includes results of the “*Escuela Técnica Superior de Ingenieros Informáticos*” (the old “*Facultad de Informática*”), also located at the Campus.

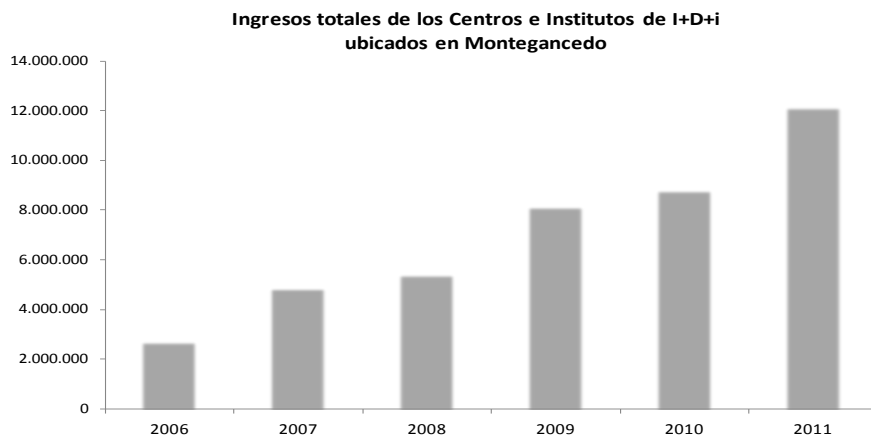


Figure 12. Evolution of incomes of the research centers of Montegancedo
(source: Vice Presidency for Research, UPM)

As shown in figure 13, there are differences in income levels between research centres of the Campus of Montegancedo; but it is precisely in the cases of **CEDINT**, **CBGP** and **CTB** where the UPM has allocated economic resources as repayable loans where it is easier to see relevant

growth rates in a few years¹³. Furthermore, the centres with more intense research activity are those which have increased their incomes faster. It is probably a consequence of the positive effect derived from the critical mass reached in human resources and the availability of competitive scientific equipment.

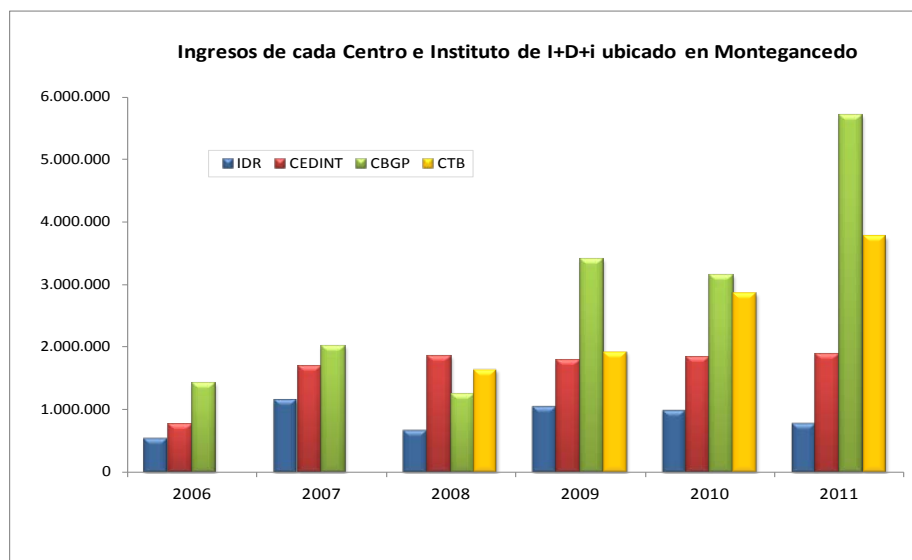


Figure 13. R&D and innovation income evolution in the Montegancedo research centres during the period 2006-2011

Another very relevant performance indicator is the participation of the research groups located on the Montegancedo Campus in the **Seventh Framework Programme of R&D and Innovation of the EU (FP7)**. In general terms, the overall participation of the UPM in the FP7 is very relevant; the UPM occupies the first position in volume of economic resources obtained as well as the number of contracted projects amongst the Spanish universities (data from CDTI up to 2012).

The Table 1 summarizes the UPM's participation since the beginning of the FP7 up to September 2013 distributed through the different specific programmes. The **Cooperation Programme**, implemented through consortia-based projects usually led by industry, is the most important in revenues obtained by the UPM as can be seen from the figures in table 1.

¹³ The CAIT (Centre of Support for Technology Innovation) has not been conceived as a research centre but as a "support centre". For this reason, its activities are not included here under this perspective.

Evolution of strategic objectives of ICE Montegancedo

Data of UPM proposals until August 2013		28/08/2013
No. of proposals participated by the UPM in FP7		1,238
No. of proposals coordinated by the UPM in FP7		289 (23.34%)
Data of UPM approved projects until August 2013		28/08/2013
No. of approved FP7 projects		280
No. of approved FP7 projects coordinated by the UPM		63 (22.5%)
Total UPM grants in FP7 projects		79,024,439.75 €
No. of proposals pending of evaluation		3
Success rate FP7		22.67%

Programa	Propuestas	Proyectos	Subvención
COOPERATION & JTI	924	195	58.554.094,99 €
PEOPLE	139	47	10.270.275,66 €
CAPACITIES	78	14	3.061.057,81 €
IDEAS	73	4	5.149.941,10 €
EURATOM	24	20	1.989.070,19 €
TOTAL	1238	280	79.024.440 €

Table 1. Participation of the UPM in the FP7 (January 2007 - August 2013)

The most important data related to this Report is the very heavy weight of the research groups located on the Montegancedo Campus in the total participation of the UPM. In relation to Table 1, the Montegancedo Campus is involved in **79 projects worth €27,501,496**.

Table 2 differentiates the participation in the FP7 of the research centres and institutes of the UPM up to August 2013 (those located in the Montegancedo Campus are in red). As we can see, the first positions are occupied by the centres created and located in Montegancedo in recent years. The participation of CBGP is very relevant in the Ideas and People programmes rather than in the Cooperation Programme as a consequence of the different type of activity (a more fundamental one) carried out there.

Evolution of strategic objectives of ICE Montegancedo

RK	Centro I+D	Proyectos	Subvención	COOPERACION	PEOPLE	IDEAS	CAPACIDADES	EURATOM
1	CTB	26	8.676.208,46 €	23	3			
2	IES	12	7.041.149,14 €	9	2		1	
3	COM	18	5.904.417,62 €	14	3		1	
4	CBGP	13	4.261.646,92 €		10	3		
5	CEDINT	9	2.810.726,03 €	7	1		1	
6	CEIGRAM	12	2.471.380,50 €	11	1			
7	CAR	8	2.248.397,00 €	5	3			
8	ISOM	5	2.059.645,55 €	2	3			
9	IFN	22	1.979.893,56 €	2			3	17
10	CEMDATIC	3	1.490.785,70 €	2	1			
11	TRANSYT	8	1.093.542,38 €	8				
12	CEI	6	1.037.956,69 €	5			1	
13	CENTRO LASER	2	775.617,00 €	2				
14	INSIA	2	623.532,00 €	2				
15	CITSEM	5	616.116,36 €	5				
16	CITEF	3	329.010,00 €	3				
17	IDR	1	192.463,00 €		1			
	TOTAL	155	43.612.487,91 €	100	28	3	7	17

**For a correct interpretation of data in table 2, notice that the table has considered all FP7 projects since 2007 even when some of the research centres were created in a later date (this is the case of CTB, CEDINT or COM). In this line, all the FP7 projects obtained by faculty members were included although some of them were carried out in different engineering schools. This situation is relevant in the case of COM where the activity was carried out in the labs of ETSI Informáticos and in the ETSI Telecomunicación and not in the research centre.*

Table 2. Participation of research centres and Institutes of the UPM in the FP7

Additionally, the Institute IMDEA Software is participating in two programmes: 7 Cooperation projects and 2 People projects.

Specifically, **45% of the total participation of the UPM is in the priority of Information and Communications Technologies (ICT)** within the specific **Cooperation** program. These data confirm the adequacy of the commitments made by the UPM by focusing the **I2Tech proposal** in the ICT domain during the preparation of the proposal in the call for International Campus of Excellence.

These incomes for R&D and innovation activities are also reflected in the scientific results generated. Figure 14 represents the overall evolution of the UPM in the number of articles uploaded in the “Web of Science” (WoS) in the period 2004-2012. Note the strong growth

obtained, where the **initial number of publications at the beginning of the data series in 2004 has doubled in just a few years.**

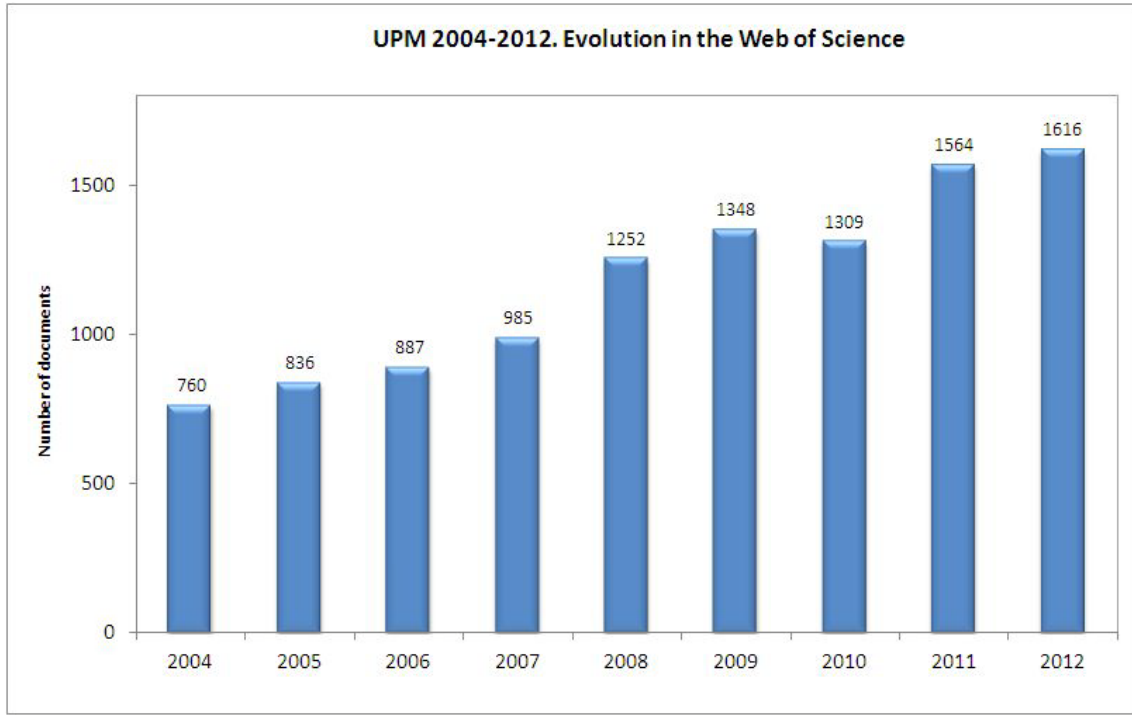


Figure 14. Evolution of the UPM documents uploaded in the WoS

Figure 15 represents the 2012 distribution of these articles for each of the research centres and institutes of the UPM. Note that the first two positions are occupied by the **CTB** and **CBGP** respectively, both located on the ICE Montegancedo.

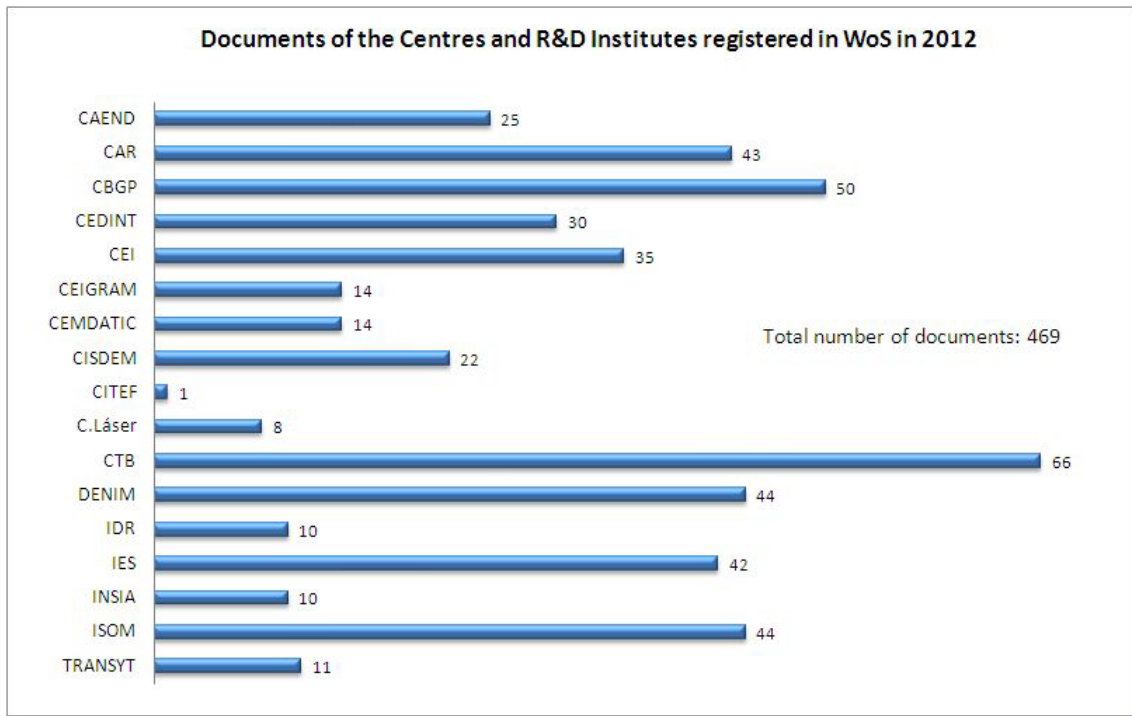


Figure 15. Distribution of articles uploaded in the WoS (2012) for the research centers and institutes of the UPM

Another set of highly relevant indicators from the point of view of the achievement of ICE Montegancedo objectives is related to the evolution of results in the support to technology innovation. Figures 16, 17 and 18 respectively present the evolution in the **number of patents** granted to the UPM by the OEPM (and how many of them are linked to research centres), the **incomes deriving from licenses of knowledge and technology** (fundamentally protected technology) and the evolution in the number of technology-based businesses **created by the UPM**. Considered overall, these positive results show the advantages of pursuing a strong institutional will in improving the UPM research performance.

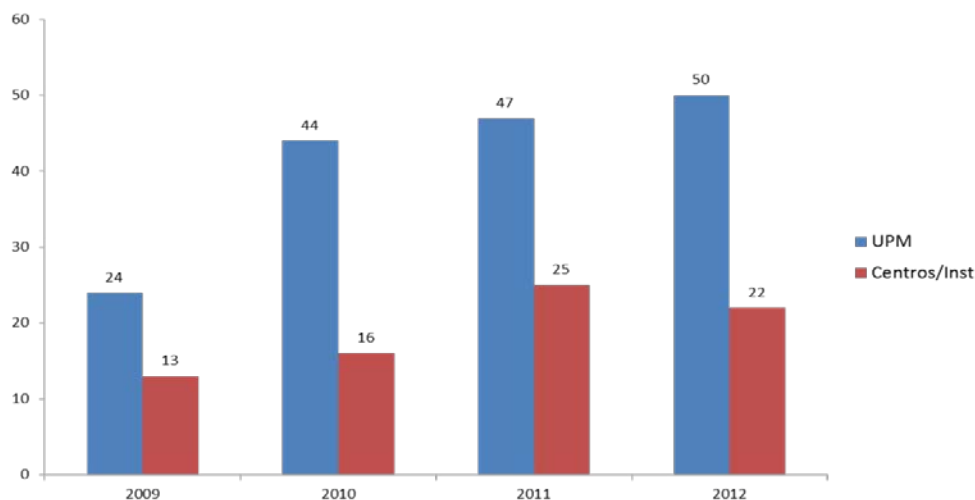


Figure 16. Evolution of patents granted to the UPM by the OEPM

In spite of the substantial increase in patents granted to the UPM represented in figure 16, the evolution of royalties obtained from license contracts is much more moderate. Figure 17 describes the evolution in the number of license contracts and royalties (in both cases the figure includes an estimation of the number and revenues at the end of 2013).

Even if a positive evolution can be observed in both indicators, the potential capacities and performance of the UPM should be very much more than the €400,000 estimated in 2013; however, by considering the license contracts signed up in recent months; these figures will increase significantly in the coming months¹⁴.

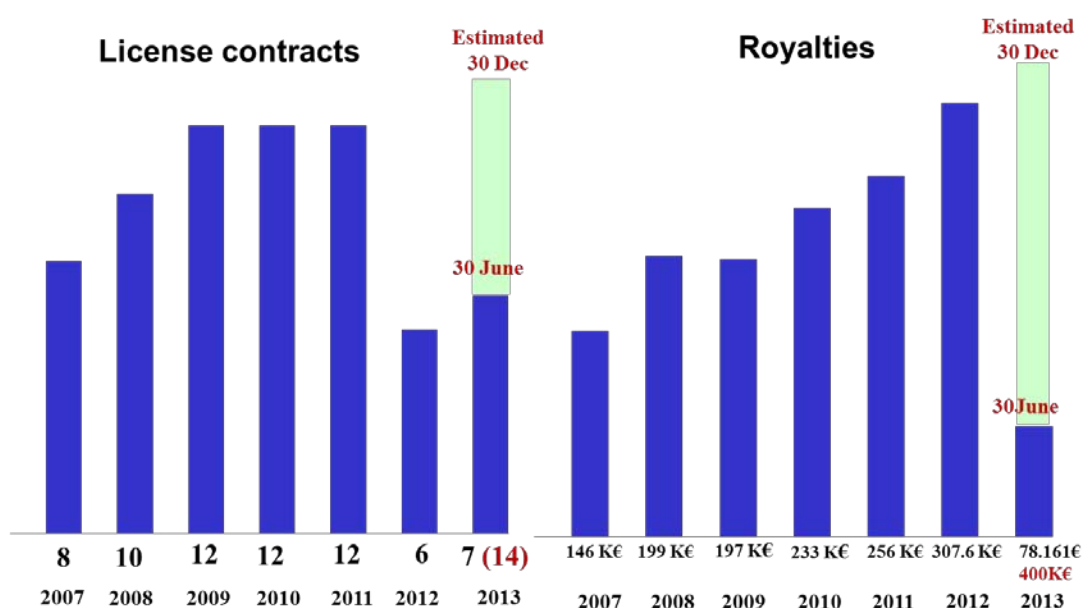


Figure 17. Evolution of licence contracts and royalties

Finally, another relevant indicator is the evolution in the number of technology-based businesses created from the UPM competition programme (*actúaupm*). As you can see (figure 18) the UPM has created 17 new technology-based firms in the last year and the intermediate results of 2013 allow a similar or even higher numbers to be estimated at the end of the current year. These results also came from a positive growth in the number of participating teams (in 2012 the UPM received over 500 business ideas in the competition contest).

¹⁴ It should be taken into account that the revenues from licensing are generated during the whole protection period and not only during the first year of the contract as a function of the units sold by the company receiving the license. Therefore, the increase in the amount received in royalties will grow in a progressive way.

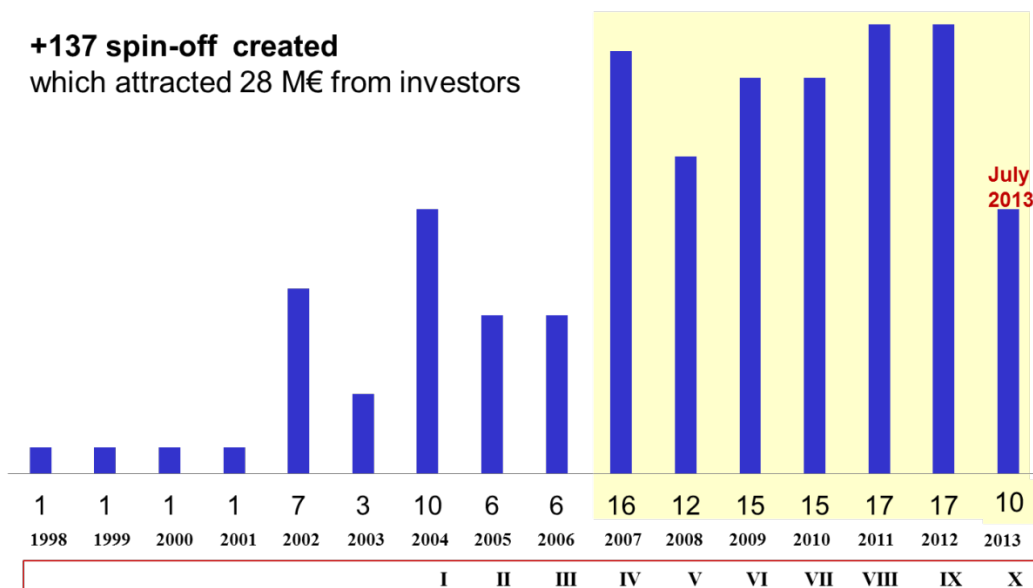


Figure 18. Evolution of the technology-based enterprises created by the UPM

It is a significant fact that the survival rate of spin-offs is 84% after three years since their creation. These new businesses have obtained up to €28M of funding in several rounds of negotiation since 2007. Overall, these data demonstrate that the UPM is in the top positions of Spanish universities in number of patents, licenses, and creation of technology-based enterprises.

3. Strategic decisions in the evolution of ICE Montegancedo

The main results obtained in the development of ICE Montegancedo during the last four years (2010-2013) which have been summarised in the data presented in the previous section were based on the UPM assumption of four **strategic institutional decisions** that have evolved since its obtaining of official recognition as an ICE as follows:

1. **Prioritisation of the use of the Campus to the development of new R&D and innovation activities**

The Campus was conceived as a fundamental element for the expansion and **strengthening of the R&D and innovation activity** of the UPM (and not specifically to the expansion of teaching activities) in all the centres located there; for this reason, the UPM has tried to optimize the available space in the finalized new infrastructures with the following priorities:

- a. **Construction of new research or technology centres** promoting the use of the available buildings from a "multi-centric perspective". The objective is to be

able to share the research of the Campus between two or more research centres. The objective behind this is to distribute the operating costs and to facilitate synergies between centres located in the same building.

- b. Support the **creation of joint units with the business sector** in research centres in order to increase the joint exploitation of research infrastructures and the commercialisation of research results.

2. **Sharp reduction since 2010 of the use of reimbursable loans from open calls published by public administrations.**

This objective, even when it has brought about the slowing down of the planned process for the physical development of the Campus as a consequence of the reduction of the available funds for launching new activities, has been carried out for the following reasons:

- a. **Progressive increase of the interests and available conditions** required by the public calls of the General State Administration¹⁵. This fact has made the repayment process more difficult taking into account the type of activities to be carried out (for example, grants for doctorate candidates). Additionally, there is a much more restrictive debt policy for public entities which require previous authorisation.
- b. **Implementation of a more restrictive financing policy** in the UPM on the use of this financial instrument in order to ensure that the annual commitment for repayment would be up to 2% of the annual budget. This policy has led to the impossibility of participating in some open calls and the implementation of decisions to extend the repayment periods.
- c. Setting up of a **shared funding commitment policy** to be used for the repayment of loans. It is based on the contribution from the General University Budget and from the resources obtained by the units located in the centres built with loans. This commitment, assumed by the affected units located in the Campus also has two associated objectives: to facilitate the medium-term economic feasibility of those units, and to ensure that they develop some

¹⁵ The development of the activities of the Campus of Montegancedo was funded from the resources obtained in the open calls for supporting Scientific and Technological Parks and the calls for International Campus of Excellence published by the Ministry of Education and the Ministry of Science and Innovation, and in a second phase by the Ministries of Education, Culture and Sports, and Competitiveness and Innovation. In addition to these resources, the UPM has also obtained the investments coming from a number of agreements with the private sector.

actions to increase the volume of economic resources from their R&D activities.

3. Progressive involvement of activities with the business sector

The initial proposal presented in 2012 and positively evaluated by the Ministry of Education clearly set up the orientation of the Campus towards technological innovation; that goal is only possible to reach through the signature of **strategic agreements with a number of private entities**. Without them, it would not be possible to ensure a close relationship between the research activity and the later commercialisation of the results obtained. This objective is related to the specification of a technical university as is the case with the UPM.

The implicit objective was, therefore, to reinforce **excellence in the innovation process** as a significant element compared with an exclusive concept of scientific excellence usually associated with the concept of excellence.

This objective has been implemented by prioritising the following set of detailed objectives:

- a. **Creation of R&D and innovation centres, laboratories for joint research units with the business sector** closely linked to the activity of research centres of the UPM. The intention behind this objective is not only to set up new joint centres (although this option is not forgotten) but to complement it with lighter institutional approaches such as the creation of a “joint lab or research unit”.
- b. **Location of enterprise-based units** in the R&D and innovation centres of the UPM supported by agreements for the shared use of facilities and the carrying out of R&D activities. The objective of this policy is to facilitate a close relationship with aggregations, by complementing the traditional model of the location of firms’ units in “business centres” or “business incubators” which has been the usual strategy in the scientific and technology parks.
- c. **Exploitation of results and technology integration** through the signature of agreements with specialised national and international brokers (both with enterprises or individuals) in industrial sectors where the UPM had capacities and promising technologies.

4. Strengthening the internationalisation process of ICE Montegancedo

The UPM has considered the development of **ICE Montegancedo** as an opportunity to accelerate the internationalisation process of the University from a multi-directional point of view:

- a. **To attract the interest in locating** cooperation activities with business or the public system of other countries **on the Campus** after signing specific agreements.
- b. **To support the physical presence of the University in other countries** by setting up long-term agreements between entities located in the Campus with entities in other countries.
- c. **To support the internationalisation of the R&D and technology transfer activity of the UPM** by using two types of action:
 - a. Strengthening of the participation in international research programmes. From this perspective, the continuous improvement of the UPM participation in the R&D FP of the EU (the UPM has a volume of contracts of over €80M in FP7), in ESA, EUREKA, COST research projects, or in open international calls issued by private (as happens with some large foundations) has been constants in the period covered by the Report.
 - b. Signature of agreements with private entities to accelerate the exploitation of results in countries where opportunities have been detected. The goal is to take advantage of the existence of many alliances with multinational businesses in which a relevant part of their R&D activity is done outside of our borders; in these cases, the technical/commercial structure could be very useful to facilitate the joint exploitation of results at the international level.

In agreement with these strategic objectives, the **decisions made** were first proposed and discussed in the Direction Board of the University with the Rector and then, in the **Research Committee** of the UPM. Finally they were approved by the **Social Council** and the **Governance Council** of the University by following the procedures set up by the UPM Statutes in those cases where it is necessary.

4. Physical development and research capacities of the Campus

4.1. Construction of new buildings for R&D&I

The most important strategic decisions as regards the **location of new units** in the available space adopted in the period 2009-2013 have required the construction of new buildings. In summary, the new actions carried out in the Campus have been as follows:

1. **Construction of the Business Centre** (see figure 19) financed with the help of the Madrid Regional Government and which houses the Montegancedo incubator for technology-based businesses¹⁶.



Figure 19. Business Centre in Montegancedo

2. **Construction of a new research building** (see figure 20) financed with help from Science and Technology Parks which currently house:
 - a. **The Centre for Smart Homes (CEDINT)** totally operative. A virtual reality cave, which will be presented later, has been installed in this centre. Since 2013, this centre has also housed a new 3D manufacturing laboratory.
 - b. **The Madrid Centre for Supercomputing and Visualization (CESVIMA)** totally operative. The Magerit-2 supercomputer, which will be seen later, has been installed in this centre. This centre was initially conceived as a research support centre offering supercomputing support. The process of transforming this centre into an R&D&I centre began in 2013, maintaining the supercomputing service.

¹⁶ This building was built in 2006-2007 and therefore it existed before the existence of the International Excellence Campus.



Figure 20. View of the CEDINT/CESVIMA building

3. **Construction of a new research building** (see figure 21) financed with help from Science and Technology Parks which currently house the Centre for Biotechnology and Plant Genome (CBGP).



Figure 21. CBGP (main building and view of a laboratory)

4. **Construction of a new research building** (see figure 22) financed from the call from Science and Technology Parks which currently house:
 - a. **Centre for Biomedical Technology (CTB)** which is totally operative (although its approval was given prior to the recognition of the Montegancedo ICE). In this centre there are joint laboratories with the CSIC (Cortical Circuit Laboratory), the UCM (Cognitive Neuroscience Laboratory) and URJC (Medical Imaging Laboratory). There is also a joint unit with Elekta for the exploitation of magneto-encephalography systems.

- b. Creation and location in this building of the "**Centre for Open Middleware**", a **new joint technological centre of the UPM** with ISBAN, PRODUBAN and Santander for the development of open intermediary software platforms.



Figure 22. Image of the building that houses the CTB and the COM

5. **Construction of the building for the headquarters of the IMDEA Software Institute** finalised in June 2012¹⁷ (see figure 23) financed by the Ministry of Finance through funds from FEDER and the Madrid regional Government.
 - a. This building will also house the central organ of the Spanish node of the Community of Knowledge and Innovation (KIC) called the ICT-Labs of the European Institute of Technology and Innovation (EIT) (see below).
 - b. Likewise, since 2013 the Joint Research Unit (JRU) between Telefónica and IMDEA-Software has been housed there.
 - c. It is also envisaged to provide space and services to some members of the UPM-IMDEA Software joint research groups.

¹⁷ The official inauguration of the Centre took place in July 2013 although it has effectively been occupied since the end of 2012.



Figure 23. Images of the IMDEA software Institute building

6. **Construction of the building for the extension of the current Business Centre** (see figure 24) financed by resources of the Montegancedo ICE and finalised in March 2013. It is already operative. This new building houses the following:
 - a. Support Centre for Technology Innovation (**CAIT**) with different units and living labs. Its description will be implemented around the perspective of innovation of the Campus later on.
 - b. Location of the **Research Centre for Heritage Studies (CIESP)**: A mixed research centre with the *Universidad Complutense de Madrid* and in an activity jointly financed by with the ICE Moncloa oriented towards the use of TIC in the **maintenance and management of architectonic heritage**. The envisaged areas of activity are as follows:
 - i. Architectonic information systems
 - ii. Volumetric simulation of actions
 - iii. Refurbishment of historic centres



Figure 24. The CAIT and CIESP building

The “**FabLab** Laboratory” (for 3D modelling) of the ETS Arquitectura which was assigned prior to the CIESP has been installed in 2013.

In short, the UPM has made a **considerable effort to develop the** Montegancedo ICE **with new buildings that house research and support centres in a commitment to make the ICE a model of integrated development in a triangle of knowledge.** Nevertheless, this effort would be useless if advanced scientific equipment or qualified human resources were not available. Both elements will be detailed in the following sections of this report.

4.2. Acquisition of scientific equipment

These activities have been accompanied by the different **acquisitions of new scientific equipment** which have required the help of the decision-making and contracting bodies of the UPM.

A first series of large singular equipment such as the five-face, virtual reality cave at CEDINT, the magneto-encephalography system of the CTB, the Magerit-2 supercomputer of the CESVIMA, the astronomic observatory at the Faculty of Computer Sciences, the automated greenhouses at the CBGP, or the cross-beam microscope of the CTB, for CIDAr the most relevant example have allowed the implementation of research projects to be supported by attracting resources and generating the results that have been expounded in previous sections. The following figures 25, 26 and 27 allow the effort made in scientific equipment at the CBGP, CTB and CEDINT respectively to be seen.

On the part of the CBGP the existence of modern greenhouses (figure 25a) that include additional sections in order to work in level P2 biologically secure conditions with an external greenhouse to handle genetically modified organisms stands out (figure 25b).



a) CBGP Greenhouses



b) Interior of the plant cultivation Laboratory

Figure 25. Facilities of the CBGP

In the case of the CTB, the magneto-encephalography equipment (joint laboratory with the UCM) and double-beam microscopy systems (joint laboratory with the CSIC), stand out.



Figure 26. CTB Equipment: a) Magneto-encephalography system and b) double-beam microscopy system (agreement with Zeiss)

Finally, the CEDINT has a five-face, virtual reality cave which allows advanced models to be developed with different businesses.

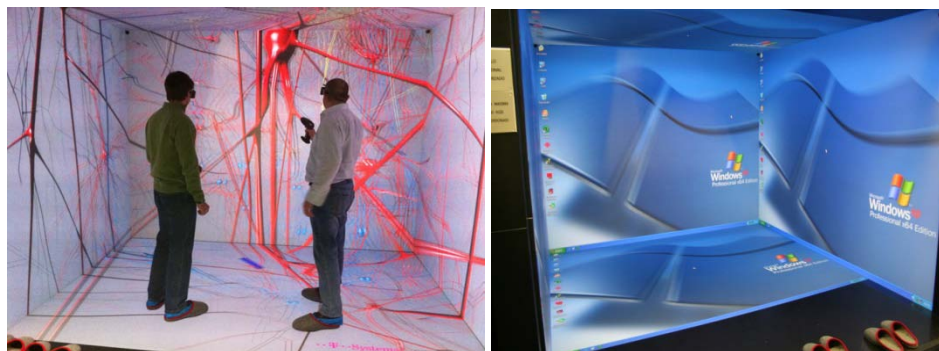




Figure 27. UPM-T-Systems" virtual reality unit (installed in the CeDinT/CeSViMa building)

The main equipment acquired in 2012-2013 which complement the equipment already existing on the Campus during this period is as follows:

1. Acquisition of the **Magerit 2 supercomputer** and its location in the CeSViMa (figure 28).

This equipment has meant an enormous qualitative leap during 2011 the high-power and supercomputer and the most energy-efficient installed in Spain. With 103.4 Tflops, 72.03 Tflops Linpack and 5,000 processors it is currently the second open-use computer in Spain.



a) Overall vision

b) nodes installed in 2013

Figure 28. Magerit-2 at the CESVIMA

2. Facilities for the **cultivation of plants under controlled conditions at the CBGP.**

Chambers have been acquired which allow plants to be cultivated at low temperatures (4°C) and to simulate the effects of freezing (-20°C), considerably widening the conditions of existing crops.

Figure 29. Cultivation chambers at the CBGP

3. Acquisition and installation of a **P3 level biological security laboratory** at the CBGP

This facility has allowed the Madrid Regional Government to be provided with a laboratory which allows research to be carried out on organisms regulated by the EU oriented to the leading plants in the world.



Figure 30. P3 biological security laboratory

4. Acquisition and installation of a **metabolomic platform** at the CBGP

With this, it has been possible to have a platform available for common use at the CBGP and initiate a new area of activity whose aim is to relate health to the nutritional characteristics of food of plant origin.

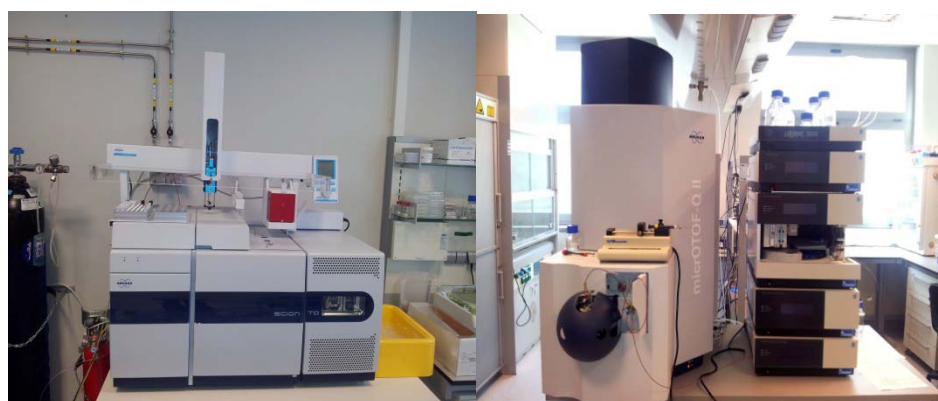


Figure 31. Chromatographs of the metabolomic platform at the CBGP

5. Installation and putting into effect of new **wind tunnels** at the IDR/UPM

- a. Fundamentally the new **ACLA-16 tunnel** for the simulation of the atmospheric layer limit in which more than 20 wind trials requested by industry. The **AB-6**

aerodynamic tunnel oriented towards the aerodynamic profiles of wind turbines. Two **twin S4-A and S4-B tunnels** designed to comply with the specific calibration requirements of industrial wind turbines, in accordance with the specifications of the MEASNET European network.

- b. Acquisition of the latest generation of instrumentation for **aerodynamic tunnel measurement**, such as, for example, laser velocimetry equipment (PIV), and new multichannel pressure readers.



Figure 32. Images of the ACLA-16 (IDR/UPM at the CIDA)



a) Mecca-Medina Talgo

b) Tower hotel en Riyadh

Figure 33. Images of trials carried out at the ACLA-16 during 2013

- 6. Installation of a **clean room for trials** at the CIDA for the USOC-E
 - a. Oriented towards experimental flight model trials of the International Space Station.



Figure 34. Control room of the USOC-E and view of the trialling hall

7. Installation of the *Functional Characterization of Magnetic Nanoparticles Platform*.
 - a. Through an agreement with the Centre for Biomedical Research in a network in Bioengineering, Biomaterials and Nanomedicine, the campus, with headquarters at the CTB, has an infrastructure for research into nanoparticles in the field of biomedicine and biotechnology.
 - b. This platform is complemented with a new facility for Atomic Force Microscopy and cellular cultures, also installed at the CTB.



Figure 35. Laboratory for the characterisation of magnetic nanoparticles (CIBERbbm-UPM)

8. Installation of the **Thermal Vacuum Chamber** situated at the IDR (CIDA)
 - a. Specific installation for simulation trials in a spatial thermal environment, in which, amongst other things, trials on the UPM-Sat 2 are carried out.



Figure 36. Thermal Vacuum Chamber at the IDR

9. **Clean room for the integration of small satellites** at the IDR/UPM (CIDA)
 - a. The room is finished and the integration of the UPM Sat 2 microsatellite currently under construction (launch envisaged in 2014) will be implemented. Although the satellite is of an experimental nature, its useful loads have been devised to facilitate the heating and demonstration of technology in flight for the Spanish space industry.

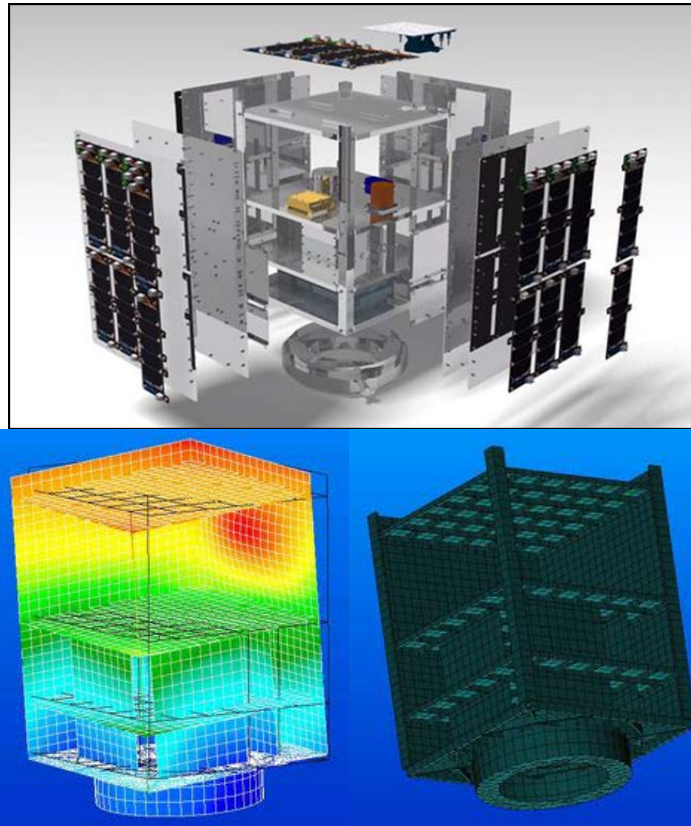


Figure 37. a) Breakdown of the components of the UPM-Sat2 satellite and b) the finite element models of its structure

10. **Concurrent engineering room at the IDR/UPM (CIDA)** after an agreement with the ESA.

- a. Equipment acquired and training in the ESA implemented to support the design of platforms and space missions.
- b. The installation has been working since October 2012 (th figure corresponds to the installation implemented at the CIDA following the ESTEC model (Norwijk, Holland) which has served as a basis for the design carried out by the UPM).



Figure 38. Infrastructure of concurrent engineering (use for UPM-SAT2)

11. **Pilot Fermentation Plant** at the CBGP (see figure 39).

- a. Installation financed by the *Bill & Melinda Gates* animal facilities foundation which allows the cultivation of microorganisms at a semi-industrial level.

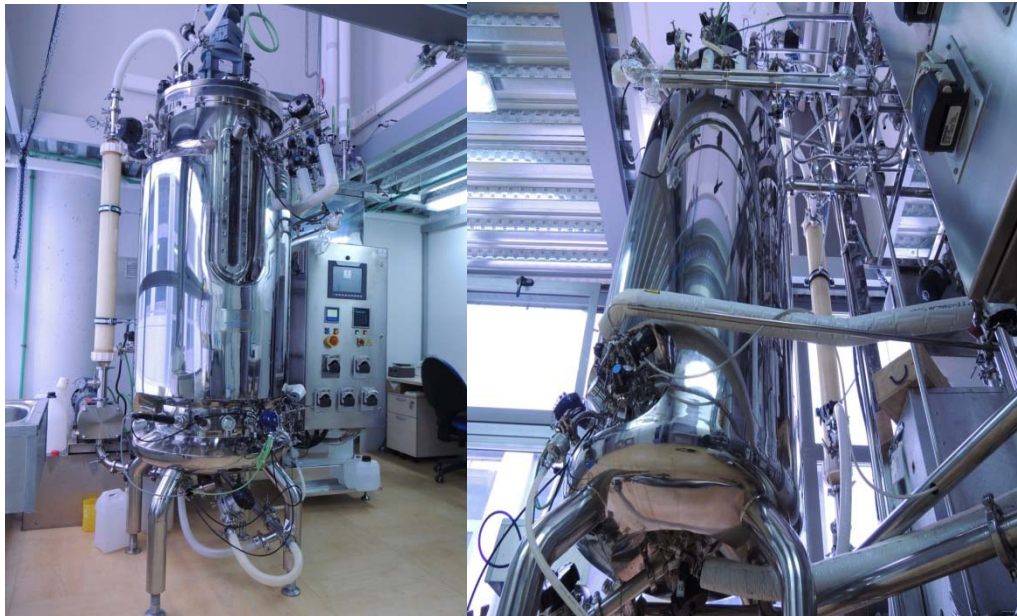


Figure 39. View of the pilot fermentation plant at the CBGP

Finally, there is an infrastructure that is considered necessary to be able to increase the experimental activity with animals and it is expected soon to have: the construction of an

animal facility attached to the CTB. Figure 40 allows the configuration that it will have to be seen



Figure 40. Future configuration of the animal facility of the CTB

Currently, after its approval by the Rector's team, it is in the administrative process of contracting through expandable modules. Its availability is expected at some time during 2013 and its complete use in 2014

The acquisition of this equipment has constituted a considerable investment which, mainly linked to the obtaining of credits coming from public calls, required a **policy of its exploitation** to be established which combines its use for fundamental research with service to business.

It must be borne in mind that the **total investment in infrastructures (buildings) and equipment** made by the UPM within the 2006-2012 period on the Montegancedo ICE (taking into account the investments financed as a UPM Park) has exceeded **€120M** which means an elevated percentage of the total investment made at the UPM for R&D&I activities during this period. These figures demonstrate the importance that the development of the Montegancedo ICE has had for the whole of the university.

5. Evolution of the ICE in the exploitation of results

The objective of support to the innovation process constitutes a key element in the development of the Montegancedo ICE: directly linked to the fundamental objective of the I2Tech project which gave rise to the fundamental proposal. This area has received priority attention throughout 2013 culminating in the construction process and later occupation of the **Support Centre for Technology Innovation (CAIT)** and the putting into effect of the **Innovatech** program for the commercialization of UPM technology as a spearhead of the CAIT activity. This

section will describe the objectives, activities and initial results obtained to date within this program.

Figure 41 highlights the role of the CAIT as an interface between the results of the groups or research groups (individually or with other associates) and the technology market.

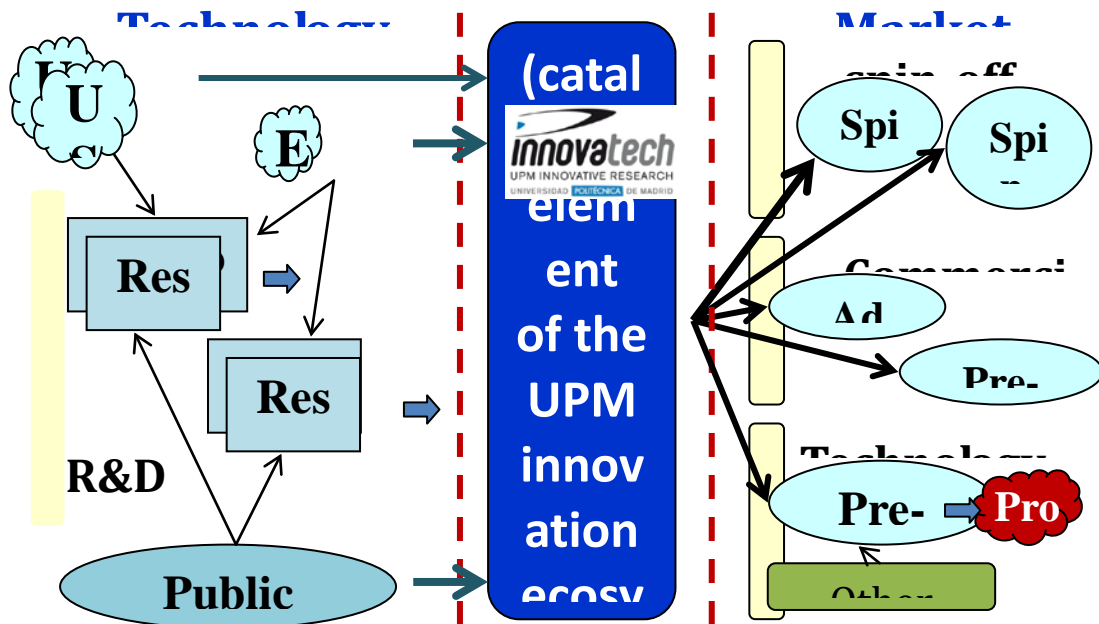


Figure 41. Strategy for the commercialization of research results

As figure 41 details, access to the market has been conceived from three complementary approaches:

- **Creation of technology-based businesses** which, by means of licensing agreements, allow the research results to be exploited. This approach may be carried out through the creation of business by the UPM itself or promoting the creation of a business with other associates or with Masters' or PhD Degree students of the UPM. Currently, the UPM has preferred not to form part of the capital of the businesses created.
- **Commercialization of the technology through agreements with already created businesses.** Again, this approach may be carried out through agreements with intermediary ad hoc businesses who help in the commercialization process (acting as brokers) or through existing large or small businesses who acquire the technology.
- Finally, the third approach implemented is centres on the **integration of the technology of the UPM with other actors**, which although it requires later development work it allows the risks involved in the commercialization process to be shared.

The three approaches have all been looked into this year; however it is still too soon to present results. With the objective of carrying out this process of support to innovation, the CAIT has been conceived with the structure detailed in figure 42.

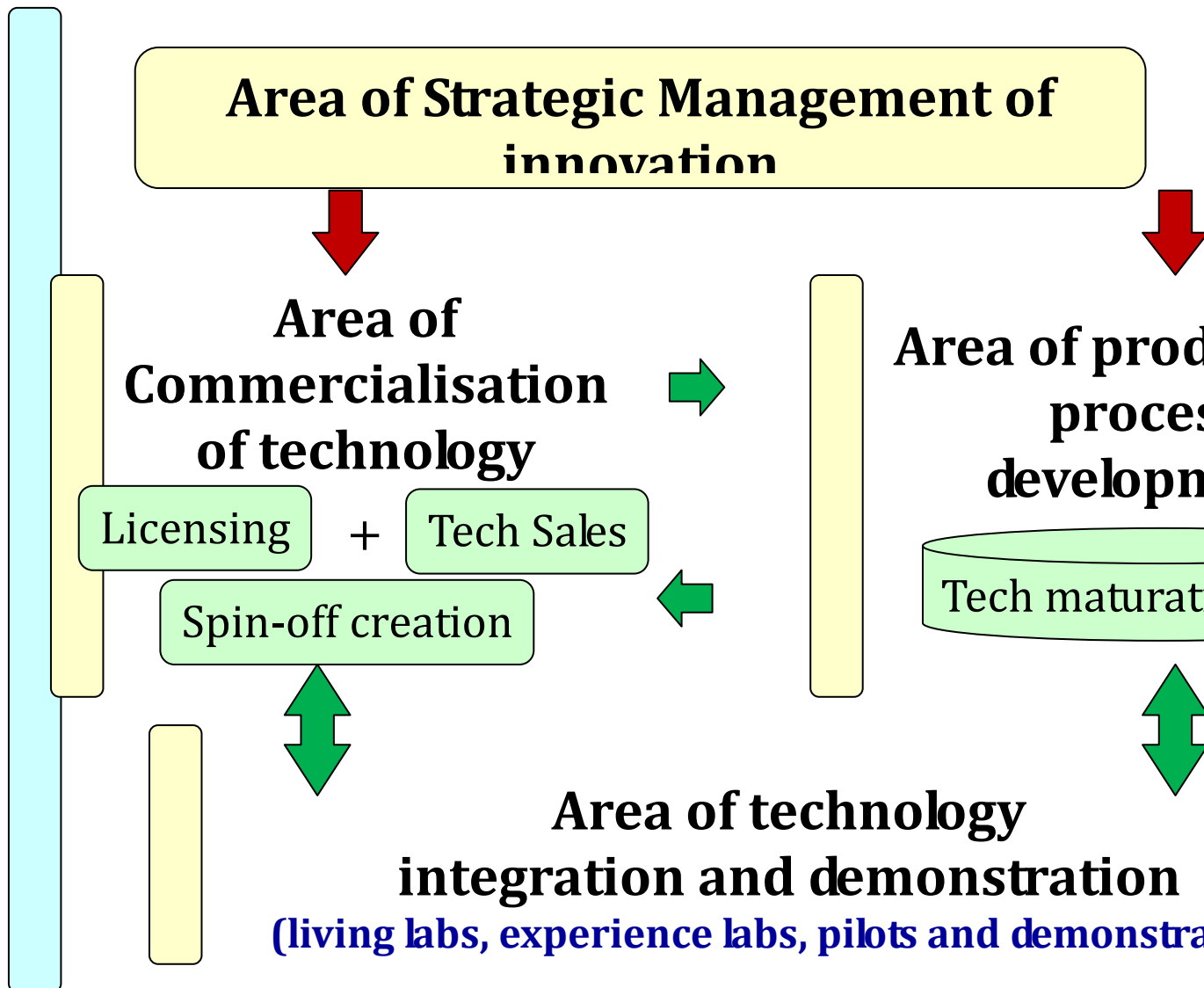


Figure 42. Areas of activity of the CAIT

The area of **strategic management** is focused on supporting the internationalization of the innovation activity of the UPM, specialised training in this area for researchers and teachers of the UPM, and the beginning of an incipient strategic consulting activity that will be fully developed in 2014.

The other three areas are intimately linked. The commercialization of technology is clearly associated with the existence of technologies sufficiently developed for their commercialisation (which is not usually the case of the results of a research process although this is of an applied nature). For this reason, a totally new area has been designed whose

objective (see figure 43) is **to identify promising UPM technologies** for their commercialisation process and a later “**maturation project**” for some of them which allows, not only a more mature technology to be obtained but also a series of activities linked to their pre-commercialisation to be carried out.

By September 2013, **60 technological UPM solutions** have been identified with a potentiality for commercialisation at a world level for which commercial files have been drawn up for 30 of them. It is expected that all of the commercial files will be available by the end of the year together with detailed market studies for about ten of them. Some of these technologies are already being commercialised throughout 2013 with others in the negotiation process with intermediaries from other countries as will be set out later.

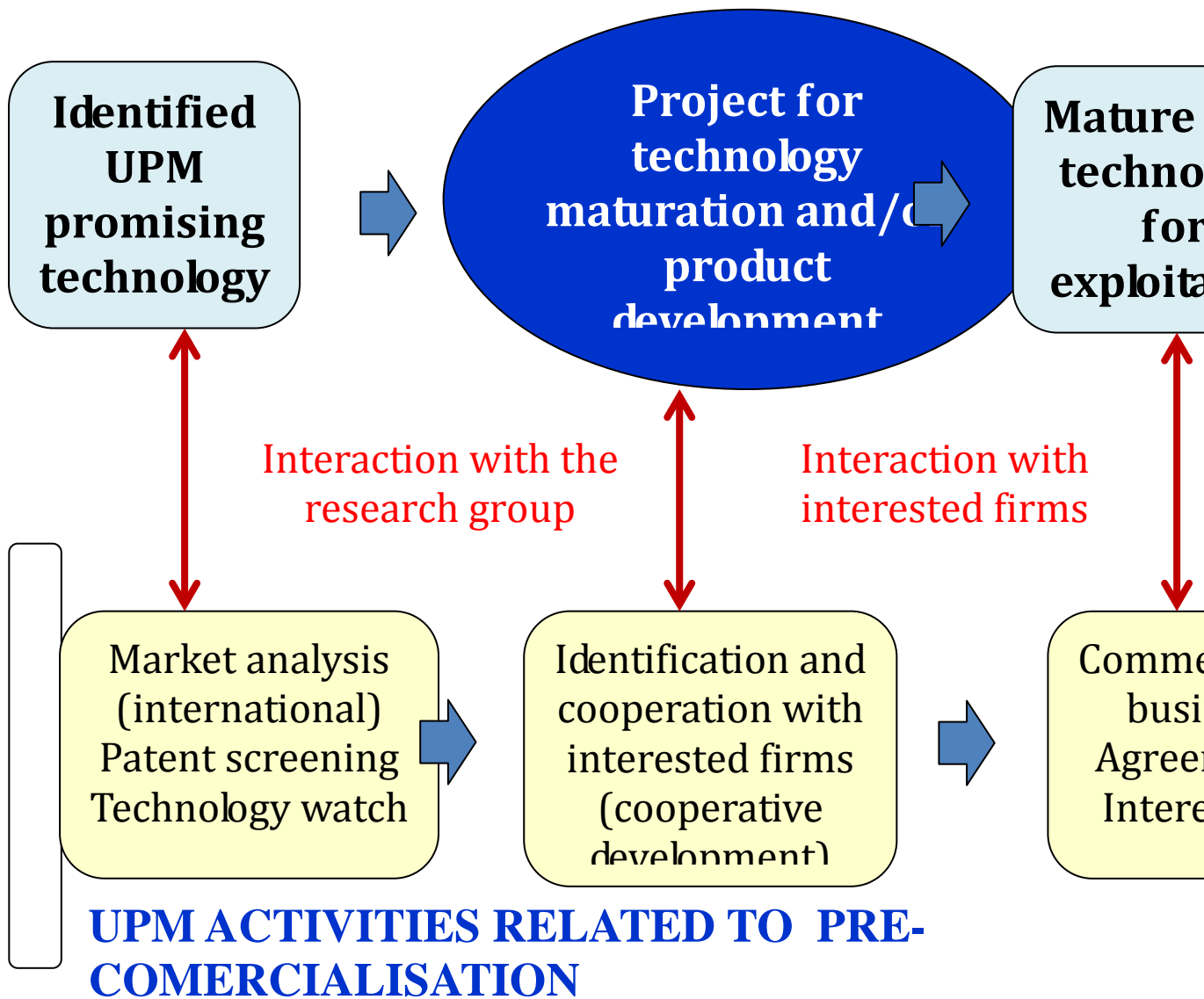


Figure 43. Strategy for the commercialisation of technology

Figure 44 incorporates the information relative to one of the commercial files designed to describe one of the technological solutions developed by the UPM (the file presented refers to *LILIAC*)¹⁸. As can be seen, the first part describes in commercial terms the type of solution and areas of application in which its commercialisation is considered feasible. The second part presents a brief analysis of market needs, the potential market to which it is directed and the advantages provided as regards pre-existing solutions. Finally, some commercial reference data, the state of protection and development, is detailed.

The objective pursued with the preparation of this type of freely available “technological file” is to capture the attention of possibly interested entities and, in the case in which there is interest, to be able to access, after the signing of the corresponding confidentiality agreement, the information detailed in it, and if considered necessary, contact the development team.

¹⁸ The document “*UPM Technology Marketplace Innovatech*” (August 2013 version) contains the commercial files of the identified technologies which have been considered sufficiently mature to begin the commercialisation process. The information has likewise been included in the Web page of the “R&D Observatory” of the UPM

LILIAC: the utmost reliability

Security and authentication device for products and brands based on a unique and disruptive technology protected by international patent

Nowadays, 10% of annually worldwide sold products are forgeries. This represents a 600 billion dollars a year loss for brands and manufacturers.

Security and authentication measures used today, such as holograms, are forged easily as exact replicas. LILIAC technology developed by Alise Devices engineers is a new generation of innovative and totally unfalsifiable security device. This technology has been developed in recent years on the facilities of CEMDATIC at ETSI Telecomunicación (Technical University of Madrid).

Due to their performance and features, LILIAC devices are applicable to products of almost all sectors of market. Through inserting them into their products, manufacturers get protection against forgery and a considerable reinforcement of its reputation and brand image.

Technology solution supported by the Technical University of Madrid

Technology solution

Alise Devices offers its customers a unique product whose technology is totally innovative. LILIAC is a plastic and flexible device, which is transparent when it's checked daylight, and with multi-image latent on both sides. These images are individually visible when polarized light or partially polarized light affects the device. This light is emitted by consumption common devices such as mobile phones, a computer screen or an LCD TV, for example.

The three LILIAC product lines (duo, quad and 256) are totally adaptable to the needs of the client. LILIAC can be inserted in any kind product, material or surface. Hidden latent images can be designed according to the client preferences.

Areas of application

- **Security:**
 - **Security and authentication of products and brands:** applied on their products, manufacturers reduce their losses from the sale of counterfeit products.
 - **Document security:** application in currency of legal tender, official documents, identification documents and other stamped products.

"LILIAC technology developed by Alise Devices gives to its holder a unique and innovative authentication system that revalued its brand image and prevent from forgery"



Market demands

- **Security and authentication of products and brands**
 - It is estimated that counterfeit goods market represents 10% of the entire volume of world trade. The annual cost of losses in the global economy due to the trade in all kinds of forgeries is higher than 600 billion dollars.

Some of the most affected market sectors are:

- **Medicines&Drugs:** with an annual volume of 200 billion dollars. LILIAC is inserted in the packaging or the blister, as a proof of authenticity for users and reducing the losses of the manufacturer.
- **Electronic equipment:** 100 billion dollars annually. The device is inserted in the packaging.
- **Clothing&Accessories:** 20 billion dollars annually, inserted in the fabric or on the label, such as distinction system, and as aesthetic and brand image reinforcement.
- **Cosmetics&Hygiene:** 3 billion dollars annually, as a part of the packaging or the main structure of the product.
- **Document security**
 - The main application is in banknotes sector. The European Central Bank found 751.000 forged banknotes during the year 2010. This amount of banknotes accounted for a fraud of more than 40 million euros.
 - Authentication system in official identification documents (identity cards, passports, visa, etc).
 - Certification of valuable documents.

"It is estimated that counterfeit goods market represents 10% of the entire volume of world trade, amounting to 600 billion dollars annual in losses for manufacturers and brands"

Market potential

- **Security and authentication of products and brands**
 - Total market potential for protection and authentication technologies applied in products and brands is estimated at 4.633 million dollar [Reconnaissance International].
 - The main substitutes for LILIAC products are holograms and RFID (1.064 and 2.2 million dollars).
 - It is a growth sector as demonstrated by the figures of two of its main actors. Bilcare Research net sales increased in a 27% in 2010. OpSec Security Group PLC, as an example of a smaller agent, increased profits in a 15% to 40 million pounds.
- **Document security**
 - In 2009, market potential of printing money services was measured in 500 million euros [Pira International].

Competitive advantages

- The unique technological benefits of LILIAC are far exceeding current substitute products.
- Due to its versatility, the device developed by Alise Devices can be inserted in any kind of product.
- Wide range of potential customers in various sectors of the market.
- Integration of the device in the final product as aesthetic reinforcement and upgrading of the brand image.
- Total adaptability of design and features of LILIAC to the client needs.

References

- First prize for the best business plan in the 8th competition of entrepreneurship actúaUPM.
- Award for the best business idea in the 8th competition of entrepreneurship actúaUPM.
- Founding team with more than 50 years of combined experience in the field of technology.

IPR

- Patent: "Procedimiento y dispositivo de seguridad documental por generación de imágenes múltiples".
 - Patent number: ES2337010 B2/ Date: 21/01/2011
 - Patent Cooperation Treaty: PCT/ES2010/000461 / Date: 22/02/2011
 - Patent applied in the USA (US13/513,517) and Europe (EP10845616.1).

Development stage

- Concept
- R & D
- Lab Prototype
- Industrial Prototype
- Production

Alise Devices Provider's contact

Carlos Carrasco, Beatriz Cerrolaza, Morten Geday, Xabier Quintana, José M. Otón
e: carlos.carrasco@alise-devices.com
beatriz.cerrolaza@alise-devices.com
w: http://www.alise-devices.com

UPM contact

Innovation, Commercialization and Entrepreneurship Area
Centre of Support for Technological Innovation – UPM
e: innovacion.tecnologica@upm.es



Figure 44. Example of the commercial file of UPM technology (LILIAC)

The last area of the CAIT set up is to provide the centre with the **capacity to experiment with the available technologies** through the existence of experimentation laboratories or *living labs* orientated to certain environments. This area is also fundamental in supporting the commercialisation process and the implication of the user in a model of “open innovation directed by the user” with the aim of obtaining the maximum feedback as soon as possible in the development process of a new product or service. In September 2013 it had:

1. **Living lab and technological demonstrator of 3D TV** (see figure 45). The objective is to demonstrate the usability of tri-dimensional TV technologies for transmission, reception, post-processing, algorithms, etc. developed at the ETSI Telecomunicación.



Figure 45. Technological demonstrator of 3D TV

2. **Laboratory for experimentation on “spaces of the future”** (see figure 46). Its objective is that of experimenting the use and maturation of mobile telematics services using networks of sensors within a general development scheme of “internet of things”. The experimentation is carried out on reconfigurable modules (up to six different simultaneously) of public halls, waiting room, office, etc. The use of proximity and geolocation sensors allows a multitude of services to be developed and experimented on by real users.



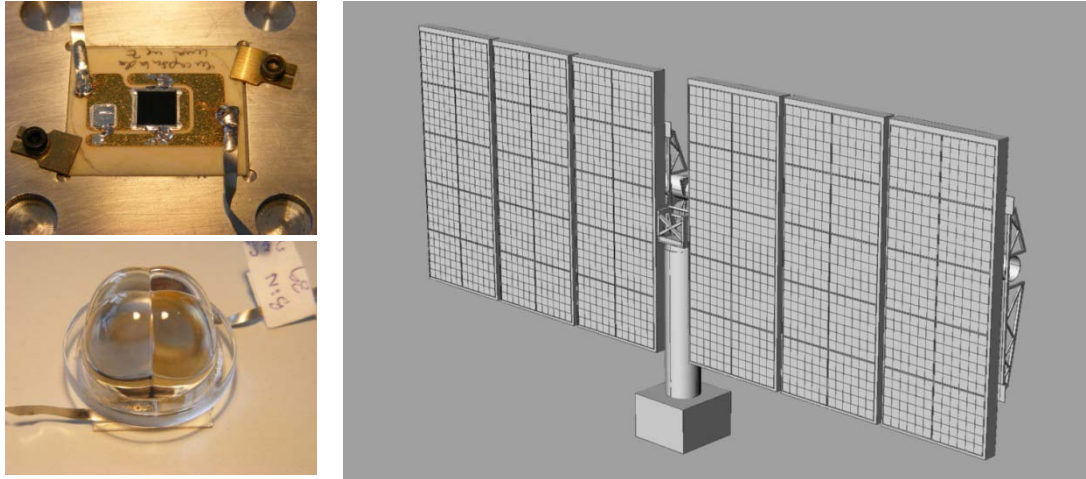
Figure 46. Experimentation laboratory on “Spaces of the future”

3. **Living lab and technology demonstrator on the “bank of the future”** (see figure 47). After reaching an agreement with the *Grupo Santander*, ISBAN and PRODUBAN, a technology demonstrator and services used will be put into effect for the banking sector in the next few years. It is expected that the putting into effect will be culminated at the end of 2013.

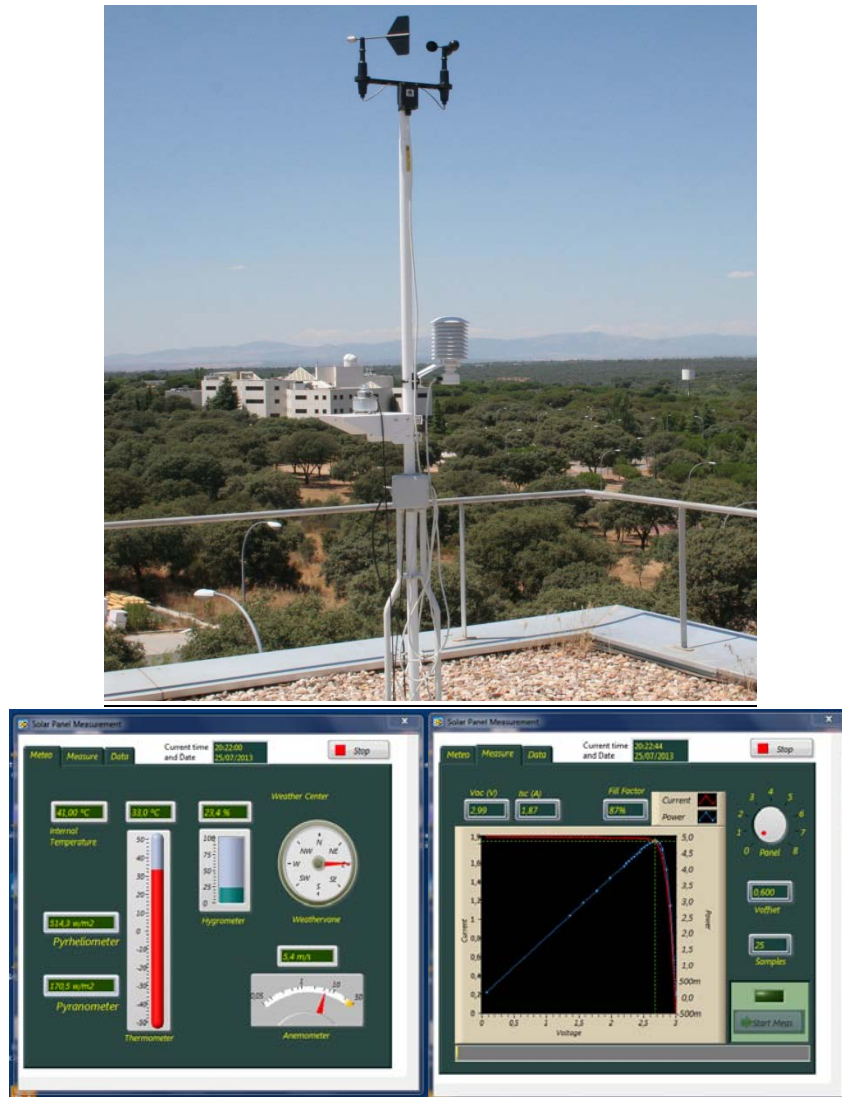
Types of projects	Description	Examples of activities
Technology exploration	<ul style="list-style-type: none"> Theoretical and practical analysis on technologies with potential interest for the Santander Group 	<ul style="list-style-type: none"> Reports on biometric identification technologies and their application in banking services. Potential use of semantic Web Smart-Cities and financial services
PoC Laboratory	<ul style="list-style-type: none"> Test of some technologies Use experiences in the Living Lab Experience simulations in the living lab 	<ul style="list-style-type: none"> Design of the future office with virtual reality Tactile interfaces (living lab) Augmented reality for specific services
PoC Campus	<ul style="list-style-type: none"> Extension of the living lab facilities to other labs (i.e. virtual reality) or in the campus (i.e. with the participation of students) 	<ul style="list-style-type: none"> Financial social networks Usability of biometric technologies in real environments (with volunteers in the campus)

Figure 47. Living lab of the bank of the future

4. **Photovoltaic concentration pilot plant.** On the upper left-hand side of figure 48 you can see the C3MJ cell from Boeing Spectrolab, on the lower left-hand side you can see the secondary FK optic place on top of a CCA of the C3MJ, and on the right-hand side is an image of one of the two arrays. The termination of the installation is envisaged for October 2013.



a) Cell, optic and array (model and “tracker installed on the terrace at CeDinT) of the de photovoltaic concentration pilot plant



b) Meteorological station and solar control system (CEDINT building)

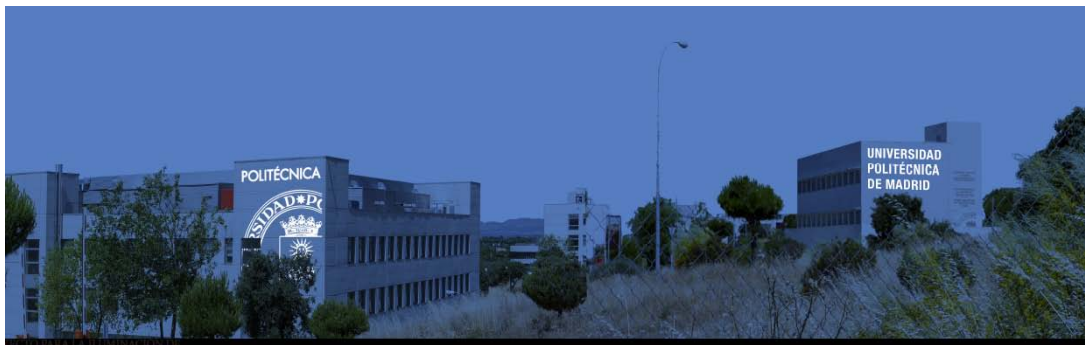
Figure 48. Elements of the photovoltaic concentration demonstrator

5. **Demonstrator of intelligent illumination in open environments.** The UPM has reached an agreement with Philips and with the collaboration of CEDINT and CAIT for the putting into effect of a demonstrator of intelligent illumination at the Montegancedo ICE which also has a network of distributed sensors designed by CEDINT and connected to exterior illumination elements.

Figure 49a describes the type of sensor used in the intelligent illumination street lamps that have been installed on the Montegancedo Campus and figure 49b allows the effect of the illumination on the facades of the buildings on the Campus to be seen.



a) Low consumption illumination installed on the Campus



b) Nocturnal illumination of buildings on the Campus (generated image)

Figure 49. Elements of the demonstrator of intelligent illumination

This demonstrator has also improved the exterior illumination of the pedestrian and car parking areas of the Campus.

The demonstration the energy efficiency of the exterior illumination complement that which is carried out at CEDINT as regards energy efficiency in the home (see the smart homes demonstration hall in figure 50).



Figure 50. Smart homes demonstration hall at the CEDINT

6. **Demonstrator of modular constructions with photovoltaic solar energy.** The UPM has participated in successive editions of the **Solar Decathlon** competition sponsored by the Department of Energy of the USA, as well as participating in the organisation two **Solar Decathlon Europe** competitions held in Madrid. As a consequence of this, there

is a series of high technology, energy efficient, single-family dwellings designed and constructed by the UPM and which are now located at the Montegancedo ICE.

Three homes designed and constructed by the UPM have been installed on the Campus and a fourth is envisaged corresponding to a donation to the UPM of a prototype of an energy efficient modular dwelling (ECHOR prototype) which served as a central module on the Solar Decathlon Europe 2012 edition. Figure 51 shows the module installed in 2013 after the competition held in 2012.



Figure 51. Modulo donated to the UPM by ECHOR (installed in 2013) and the UPM dwelling

Finally, it is possible to represent the series of initiatives developed around the CAIT in the form of a “**daisy model**” linked to the commercialization and undertaking. Each of the petals corresponds to an activity overlapping others. Figure 52 represents this model schematically.

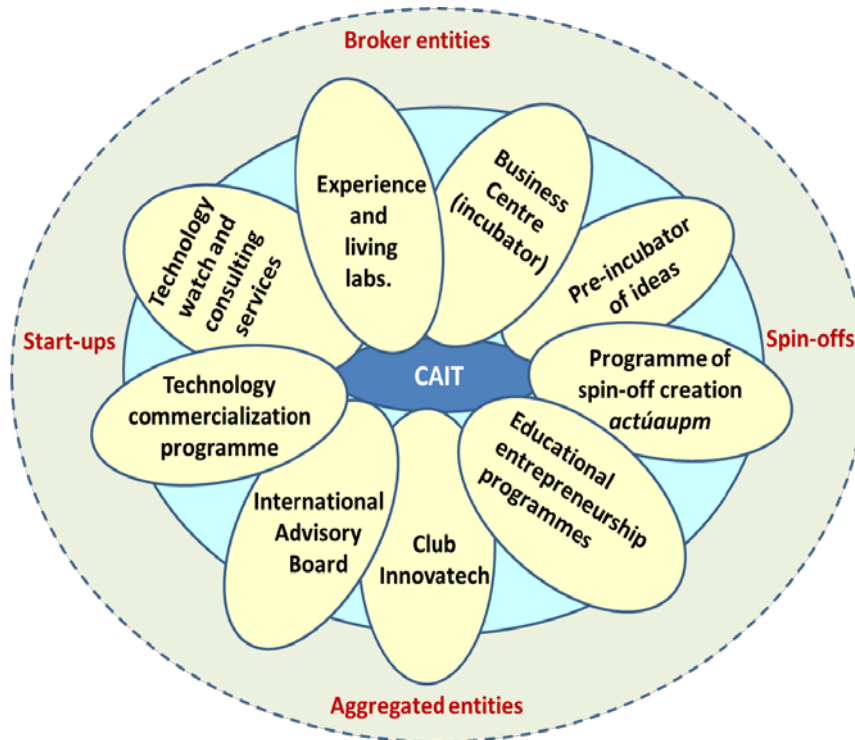


Figure 52. Instruments and activities initiated to support the commercialization and undertaking at the Montegancedo ICE

The intention proposed is to support in a coordinated manner the activities that are going on from support to the initial capturing of business ideas based on the technology and its pre-incubation (linked to the *actúaupm* program and training in entrepreneurship) up to the consolidation of the most promising ideas by means of a business centre, later strengthening the commercialization and demonstration of its results (through the use of experimenting laboratories and living labs, technological vigilance services and consulting, and the commercialisation of technology program). Finally, to be able to increase the interaction with other entities around UPM technologies and solutions, the CAIT has created and International Advisory Board (IAB), the Innovatech Club (and its network of “business angels”) etc. with the aim of completing the associated ecosystem.

The fundamental idea after the implementation of this model is to support a very dynamic structure in which additional “petals” in the model may appear and disappear without modifying the structure of the approach chosen.

6. Improving the services at the Montegancedo ICE

2013 has seen an advance in the activities undertaken to improve the general situation of the services of the Campus. It must be borne in mind however, that the UPM does not have the

economic resources necessary to cover the costs of an urban remodelling of the Campus to how we would have liked it. For this reason, the activities undertaken have focused on resolving specific important problems to improve the environment of the activities on the Campus. The activities that have been carried out are as follows:

Car parking

Construction of an additional car park and the construction of the CAIT for 22 places located in front of the CTB-COM building. This car park complements the underground one that has been constructed at the CAIT. An automatic access barrier will be installed soon.

Low consumption public illumination

This is a project to improve the illumination (a considerable priority action to improve the general security on the Campus). The development will be made by means of an agreement with the company Philips who will likewise collaborate in the development of demonstrators of intelligent illumination on the Campus.

The implementation will be carried out in the next three months with the following basic elements:

- Renovation of the public cable network (disappeared in some areas)
- Installation of LED street lamps (figure 53)



Figure 53. Low consumption street lamps installed on the Campus

- Installation of illumination of the facades of some buildings
- Establishment of a network of distributed sensors (figure 54) with the aim of generating information associated to the movement of people and vehicles on the Campus (installed in the new street lamps).

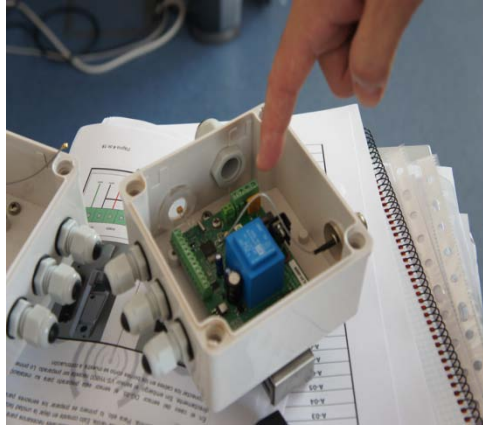


Figure 54. Sensors used in the illumination

Researcher and foreign student reception office

One of the commitments assumed by the UPM in the deployment of the Campus is the creation of a "Researcher and foreign teacher and PhD student reception office". This office will be located in the CAIT from the 1st November 2013. The corresponding office for undergraduate and post graduate students (ERASMUS, etc.) will remain at the *ETSI Informática*.

Deployment and improvement of the WIFI network of the Montegancedo ICE

Independently of the networks of wireless access WIFI existing in the interior of each of the buildings and where it is necessary to improve the coverage, it is considered necessary to have a WIFI network in some of the open areas of the Campus. The areas for priority coverage will be: the space next to the *Facultad de Informática* and the sports area. Likewise, all of the centres will see an improvement in the WIFI coverage.

Service for the printing of high quality 3D colour models

In 2013, laboratories for the printing of 3D models have been installed in the CEDINT and the CIESP (FabLab) to offer external services. These facilities complement which the CIDA had previously for its own needs in the development of experimentation models in wind tunnels. The CeDinT has a system for high definition tri-dimensional injection printing (3D Spectrum Z-510). Injection printing allows precise defined and colour features with textures configurable by software (see figure 54).



a) installation in the FABLAB laboratory in the CAIT of printing systems



b) Facilities at the CEDINT

Figure 55. Equipment for 3D manufacturing available on the Campus

Monitoring of the electric consumption in research laboratories

Coordinated from the CEDINT two consumption monitoring projects have been implemented with equipment designed and prototyped at the CEDINT. In one of the cases it has been installed in the CEDINT building (see figure 56a) and in other cases en the greenhouses of the CBGP (see figure 56b).



a) Modules for the measuring of consumption



b) Remote measuring in the greenhouses of the CBGP

Figure 56. Remote monitoring of consumption activity at the Montegancedo ICE

The project has consisted of the design of the measuring of electricity consumption modules, the design of the BMS management platform for the provision of energy efficiency and control services, the manufacture and validation of the first devices for the measuring of electricity consumption, the pre-industrialisation of the electricity consumption measurement modules, and the installation of a pilot measurement project at the CeDinT-UPM.

The following step is being carried out in the greenhouses of the CBGP which will be monitored via the Internet from the CEDINT. It is the installation of a pilot compartment for the cultivation of plants in one of the greenhouses, using non-conventional LED lamps and with the measurement and optimisation of energy efficiency to evaluate its suitability for the growing of the plants, with the consequent energy saving. The project involves the collaboration between such different centres as the CEDINT and the CBGP, and therefore, the synergies generated in the ICE.

7. Evolution of the internationalization process of the Campus

7.1. Levels and strategy for the internationalization of the Campus

The integral development of the objectives of the Montegancedo ICE demands that the **internationalization process** is constituted in a key element for its consolidation as a campus of excellence. The ICE must act, on the other hand, as a catalysing element in the achievement of this internationalization in the whole of the UPM. In this context, the UPM want to develop a model for the progressive integration of its internationalization process in levels as detailed in figure 57.

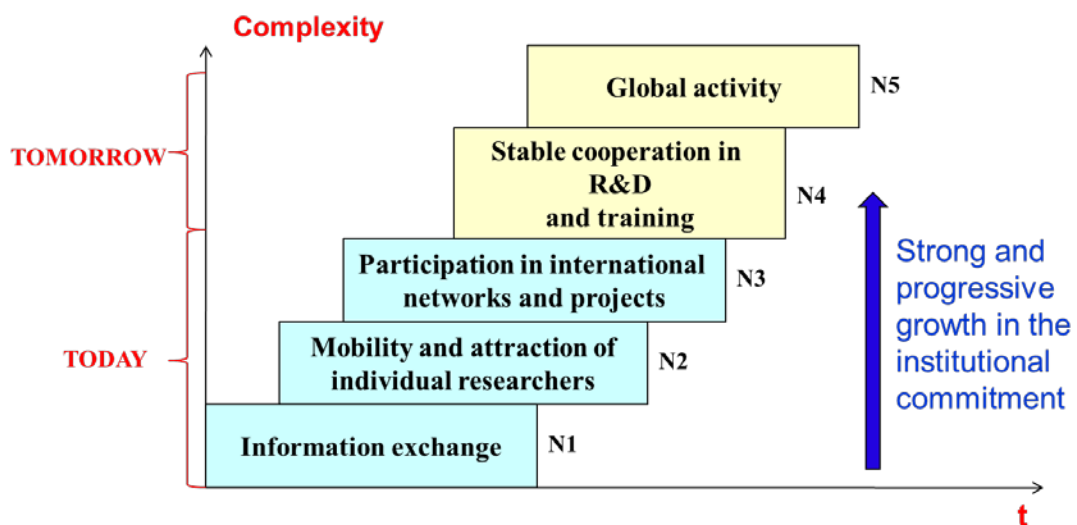


Figure 57. Levels of internationalization

Even though the first three levels are dealt with in one way or another, all universities use conventional instruments (in some cases supported by the Public Administrations), the higher levels (N4 and N5 in figure 57) require a much greater institutional commitment. The development of the Montegancedo ICE implies the institutional will to explore the use of new strategies to reach **level 4 in the largest number possible of centres** located in it.

The strategic alliances that the university can implement are concentrated from a geographic perspective in local, national and international environments. All of them coexist at a certain moment as suggested in figure 58.

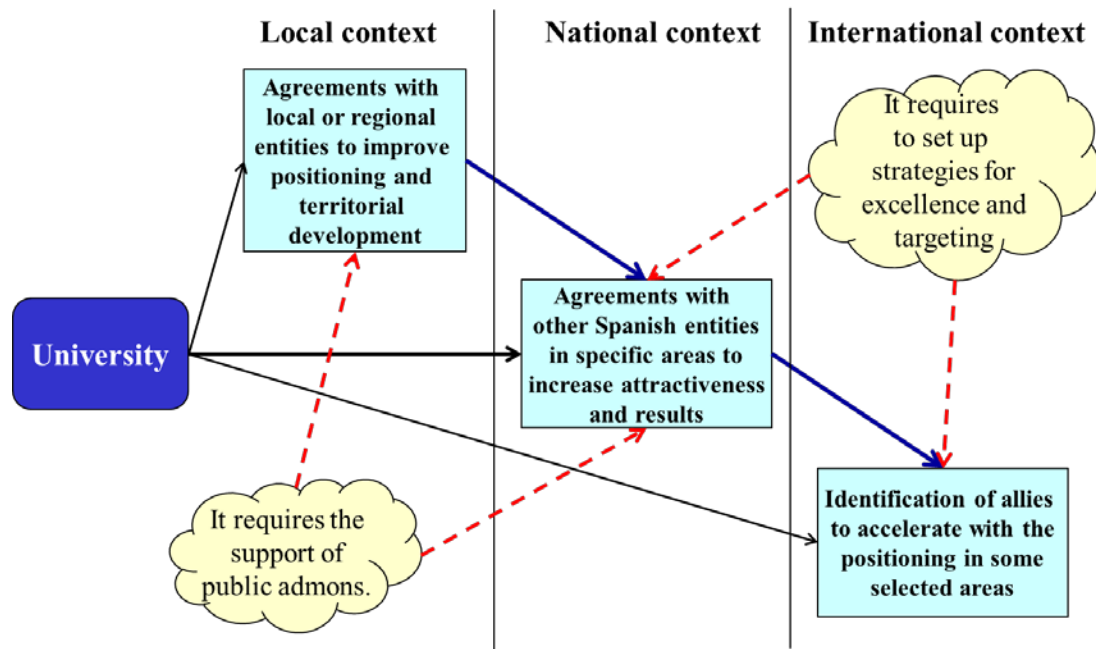


Figure 58. Strategic alliances

A key element for the UPM is to choose the most suitable allies to accelerate the strategic international position in some areas. This forces us to focus on the activities and align the interests of the UPM with the aggregations.

7.2. Strategic alliances promoted from the Montegancedo ICE

The activities initiated in this area from the **obtaining of the recognition of the Montegancedo ICE** have been as follows:

1. Creation of a **European Laboratory Associated to the CNRS and the Universidad de Toulouse in the area of computer engineering.**
 - a. This activity, initiated in 2012, has obtained financing from the 2011 call for the support to the ICE of the *Ministerio de Educación*
 - b. On the part of the UPM the activity has centred on the *ETSI Informáticos* in subjects of approximated reasoning by locating spaces in it.
2. Creation of a **Joint Research Centre in Bio-energy with the Universidad de Campinas (Brazil)**
 - a. This activity, initiated in 2012, has obtained financing from the 2011 call for the support to the ICE of the *Ministerio de Educación*

b. The centre, whose location will be implemented in 2013 on the UNICAMP campus in Brazil has the economic support of *Repsol* for the financing of two initial project lines:

- i. Microbiome of cane sugar with the participation of the CBGP
- ii. Multi-phase simulation of the transfer of fluids with the participation of the CeSViMa and the *ETSI Aeronáuticos*.

3. Agreement signed with the **University of Colorado in Denver (USA) on the subject of health.**

This activity has been carried out since 2012 with financing from the 2011 call for support to the ICE from the *Ministerio de Educación* and with the support of the Health Committee of the Regional Government of Madrid who has also signed an MoU with the University of Colorado.

To date, three lines of activity have been identified for which contacts are being developed with investors and possible financing agencies:

- a. New technologies for Neuro-regenerative Medicine. Creation of a joint Laboratory with the Centre for Neurosciences of the Anschutz Campus in Denver, Colorado. Neurology and Stem Cell Sciences (Neurosurgery, Neurology, Stem Cell Centre, Stroke Hospital)
- b. Health Computer Systems to configure Rapid Learning Networks. Initial applications: 1) the analysis of capital costs and the optimisation clinical guides for the treatment of cancer and 2) quality control and the extraction of knowledge in hospital management
- c. Development of Health and Wellness units. Technologies for applications for the promotion/prevention of health and the management of chronic patients. Specific program against Obesity. Colorado "Health and Wellness Centre" (creation of a "mirror centre" in the CTB) in which a technological platform will be created for the integration of personal data. Design of a working model of the virtual associated centre and first international pilot in Spain

4. Agreement signed with the **Forschungszentrum Jülich - FZJ (Jülich Research Centre) in Germany and the visualisation and analysis of data:**

- a. This agreement reached in July 2012 which establishes a strong line of collaboration with a large European Supercomputing centre which houses one of the largest computing systems in the world (and the greatest in Europe), and which is also one of the main research centres supercomputing and parallel computation.
- b. The activities in which a collaboration between CeSViMa and FZJ are established are:
 - i. New technologies for visual analytics in the context of the Big Data challenges, which appear both in science and industrial contexts.
 - ii. Computational neuroscience, supporting the analysis of data and modelling tools for research into experimental neuroscience and based on simulation

5. **Creation of a Node Associated with the "Community of de Innovation and Technology" (KIC) ICT-Labs** of the European Institute de Technology and Innovation (EIT)

- a. This action was signed in April 2013 with the approval of the adherence of the coordinator, IMDEA Software, and the associated Spanish group. The start of the activities is expected in January 2014, when the participants have sent the proposal of activities for the planning of 2014. This approval of adherence means an important support to the innovative activities developed at the Campus
- b. The participation will be carried out with the inclusion in the associated group of ATOS, BBVA, BSC, INDRA, Telefónica, and the UPM, apart from the IMDEA Software which acts as a coordinator.
- c. This activity is linked to the activities of the ICT-Labs nodes and the agreement reached between KIC and the PPP of the "Internet of the Future" for the putting into effect of the pilot demonstrator at the Montegancedo ICE.

6. Agreement with the **Bill & Melinda Gates Foundation**

Obtaining a large project of €2.6M (\$3M) on the part of the CBGP directly financed through the Bill & Melinda Gates Foundation to support the line of research into the Biochemistry of the Fixing of Nitrogen in the CBGP for a period of 52 months.

The humanitarian aim of NFIX is to introduce the biological fixing of nitrogen in cereals to increase the productivity of small farmers in Sub-Saharan Africa and Southern Asia and preserve, at the same time, the environment.

This project has allowed an advanced semi-industrial pilot facility of bio-fermentation to become available in the CBGP.

7. Agreement with the **Research Centre in Complex Systems** of the **CNR (Florence, Italy)**

A collaboration agreement has been signed between the CTB and the Centre for Complex Systems belonging to the National Research Committee in Italy (CNR) for the carrying out of joint activities in the application of the theory of complex systems and health system networks.

8. **FET Flagship of the European Commission with the Human Brain Project proposal**

The development of this project, coordinated from the EPFL of Lausanne (Switzerland) with whom there is a close collaboration in the development of the Blue Brain project (having obtained additionally to the Spanish financing, a complementary contract directly financed by the EPFL), has meant a relevant effort from the UPM which assumes an elevated participation of the UPM, based mainly at the CTB and the CESVIMA.

This is a **10-year research project** with a total financing that exceeds **€1.000M** (in two phases). The launch phase (ramp-up) is financed by the FP7 and from which the UPM will receive €1.5M in two and a half years (the participation of the UPM means **23%** of the Spanish total).

Likewise, the coordination of the Spanish participation will be carried out through the UPM. This activity is fundamental to assure a suitable participation in the second phase.

It is envisaged that other more focused projects will derive from this such as the focalisation of the research activity on greater knowledge on Alzheimer's disease.

7.3. Internationalisation of students and projects of the ICE Montegancedo

Evolution of strategic objectives of ICE Montegancedo

Another essential aspect that responds to the general interest established by the Ministry with the Campus of International Excellence programme is the increase in the number of students and researchers from other countries. This achievement is a strategic objective to the ICE Montegancedo and is the result of strong adaption process from the research centres.

The results obtained are very satisfactory. They are regarded to Phd students, the following table allow us to see a positive evolution during the considered period.

UPM 2009 7.12%	CEI 2009 12.36%	UPM 2011 9.51%	CEI 2011 21.08%	UPM 2012-2013 24.04%	CEI 2012-2013 49.52%
--------------------------	---------------------------	--------------------------	---------------------------	--------------------------------	--------------------------------

As it can be observed, this increase also occurs in the UPM as a whole but, if we see the ICE Montegancedo, the figure has reached nearly half of the total of students.

This data is complemented by the evolution of the research projects and the amount achieved.

También complementan estos datos de internacionalización la evolución de los proyectos de investigación y los importes conseguidos de los mismos.

Number of FP7 international projects	UPM 2009 61	CEI 2009 21	UPM 2011 72	CEI 2011 18	UPM 2013 155	CEI 2013 35
Amounts earned in international projects	9.961.660	4.497.682	19.533.618	6.885826	23.391.814	10.590.953

8. Consolidation of the relationships with the aggregations

One of the most desired objectives in the International Campus of Excellence program for the public administrations is that deriving from the consolidation of the relationships between the universities and its aggregations (be the other universities, OPIs, foundations or businesses).

In the case of the UPM on the Montegancedo ICE, its **differential reality** has been centred on the orientation towards alliances **with the business sector**. This does not mean that the alliances with the public sector are not important; in fact, the existence of the aforementioned CIDAdos international agreements with other universities in France, USA or Brazil, the existence of joint centres with INIA, or joint laboratories with CSIC, UCM, URJC, or different Spanish public hospitals indicate the relevance that it has, as occurs thus in the greater part of Spanish CEI.

Additionally, the particular relationships related to the business sector also explain this evolution with different types of instruments as shown in figure 59. The commitment acquires with the UPM is variable as is the degree of complexity of the action. As the figure shows, some of the instruments are known and used by the UPM; others are less and the aim is that the Montegancedo ICE serves for its complete development.

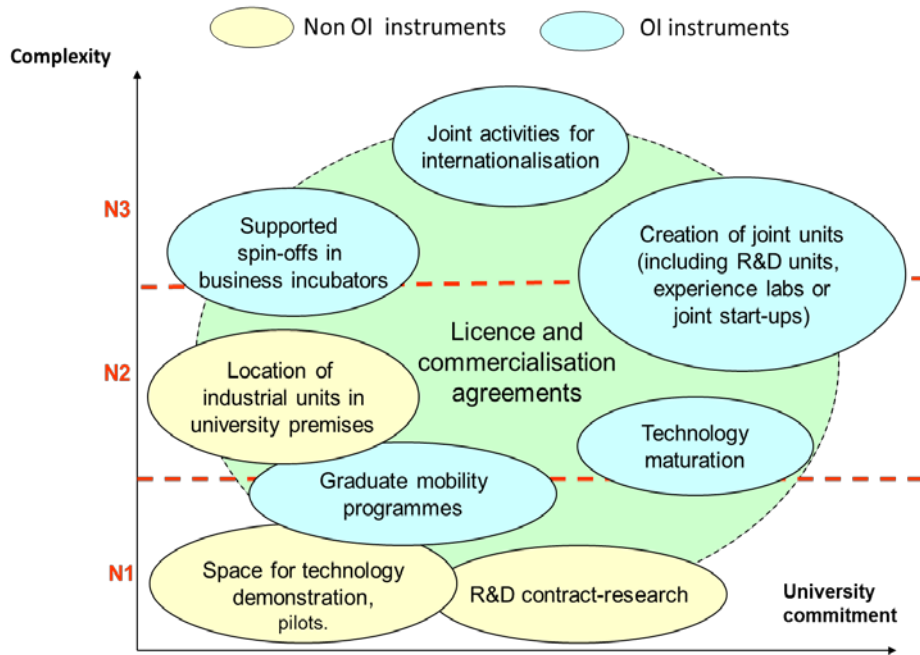


Figure 59. Typology of the activities with the business sector in the Montegancedo ICE

The existence of the CAIT also allows licensing and commercialisation of technology agreements to be promoted and established between partners and taking advantage of its presence in the Campus and making possible the existence of a common connection between all of the activities set out in figure 50.

However, when referring to a "differential reality" it indicates that this aspect has enjoyed special attention and that constitutes a specific value in the case of a university of a technological character. Through it, it has made specific activity agreements available that develop the initial agreements incorporated into the initial proposal.

The following elements of an institutional character can be highlighted in this line of activity (R&D&I projects in cooperation whose number is very high not only those long-term agreements not linked to a specific project are not contemplated):

1. Joint unit for the exploitation of the **virtual reality cave** with the company **T-Systems** for service to external entities.

2. Joint unit for the exploitation of the **magneto-encephalography system** with the company **Elekta** for the training of technicians in MEG and the development of medical protocols.
3. Collaboration agreement with **ESA** for support for the use by the Spanish business of the **concurrent engineering hall**.
4. Collaboration agreement with the company **IBM** for the use of the **Magerit-2 supercomputer** for the advanced simulation in areas of neurosciences (relationship with the international Blue Brain project).
5. Collaboration agreement with the **grupo Santander** for the promotion of an **innovative "open middleware" ecosystem** that encourages the location of new innovative businesses that make use of the available platforms that are put at their disposition (linked to the COM).
6. The UPM has reached agreements of an institutional character relative to the Montegancedo ICE with the following entities:
 - a. **INDRA** in the area of health platforms associated to the CTB
 - b. **ITP** in the area of aerodynamic trials (in a close relationship with Tecno-Getafe) associated to the CIDA.
 - c. **UCB Pharmaceuticals** (Belgium) in the area of clinical trials with the neurosciences associated to the CTB. It commenced in 2013 through an agreement for the training of professionals through the CTB.
 - d. **Telefónica I+D** in the area of the advanced development of software constituting a JRU (Joint Research Unit) with the UPM fundamentally oriented to the participation in European research programs, and another agreement with the Institute IMDEA Software in technologies for the advanced development of software and the joint participation in projects.
 - e. **Frontiers research**. The project for the creation of the Spanish node for the development of open publication software platforms by means of an agreement with "Frontiers-Research" (acquired recently by the *Group Nature*) has been transferred to the CAIT.

- f. **CISCO/CITRIX.** Agreement for the virtualization of laboratories by means of the installation of servers in the CESVIMA cloud.
 - g. **REPSOL.** Implementation of a collaboration project with the Universidad de Campinas within the Inspire program with CBGP and CESVIMA.
 - h. **Participation in KIC ICT-Labs** (associate Partner Group) of **INDRA , Telefónica, ATOS .**
7. The UPM is currently in an **advanced negotiations process** to reach agreements of an institutional character relative to the Montegancedo ICE with the following entities with whom we are confident that an agreement will be reached in the next few months:
- a. **BBVA** in the area of bio-computing associated to CBGP.
 - b. **Forum for Innovative Businesses** (FEI) and the project supported through the association of a research centre (SIRI: Spanish Innovation Research Institute).
 - c. **Fitzsimons Bioscience Incubator:** Creation of a joint incubation project between the CAIT and Fitzsimons in Biosciences.
8. The effective setting up of an **Advisory Board of the Montegancedo ICE** with the incorporation of representatives from all of the aggregations. Independently of the holding of three plenary meetings, two work groups of a horizontal character with the following subject matter have been set up in 2013:
- a. Work Group de “Commercialisation of technology”
 - b. Work Group of “Internationalization of the R&D&I activity”

9. Policy for human resources and advanced training

An effort such as that made by the UPM in physical infrastructures and in the acquisition of up-to-date scientific equipment requires qualified human resources to be available that takes advantage of the teams that generate ambitious research projects. Without having qualified human resources available it will not be possible to reach the objectives pursued. For this reason, in parallel with the development of infrastructures the existence of **programs for the contracting of PhD graduates** as set out below has been promoted.

Likewise, the training of researchers with the promotion of quality **PhD programs** constitutes an axis of the fundamental activity in the Campus characterized by a reduced number of undergraduate qualifications compared to the whole of the UPM.

9.1. Human Resources for Research

The basic structures for research at the UPM, research groups and centres and institutes de R&D&I, have a series of means for the obtaining of human resources necessary to carry out its work of scientific advance and technological development.

The relevant activities carried out in this period as regards the contracting of human resources PhD Researchers, including the IMDEA Software Institute in this aspect, have been as follows:

1. Agreement with the **BBVA Foundation** for senior researchers (each of them with a program for the contracting of PhD graduates and research staff in training):
 - a. Senior researcher in computational biology located at the CTB
 - b. Senior researcher in bio-computing located at the CBGP
 - c. Senior researcher in medical Imaging (place in process)

2. COFUND-UNITE UPM
 - a. Project co-financed by the European Commission in the People program of the Seventh Framework Program for R&D of the EU through which the contracting of PhD graduates is supported.
 - b. The program has permitted the incorporation of 18 PhD graduates in three modalities: reintegration, incorporation and going abroad.

3. AMAROUT I and AMAROUT II
 - a. Project of the Institute IMDEA Software co-financed by the European Commission in the People program of the Seventh Framework Program for R&D of the EU which co-financed the contracting of PhD graduates. The said projects attend to the needs of the seven IMDEA institutes and are coordinated by IMDEA Software. Particularly, the Instituto IMDEA Software has attracted nearly 12 international researchers to the Campus. The total number of researchers is 70; they come from universities and research centres worldwide

4. Internal program for the contracting of PhD graduates at Montegancedo ICE
 - a. Program financed with resources of the Montegancedo ICE for the contracting of PhD graduates. There are currently six PhD graduates incorporated in four of the Centres on the Campus (CEDINT, CBGP, CESVIMA and the *ETS de Ingenieros Informáticos*).

- b. The future objective pursued is to have agreements with the business sector for the co-financing of the contracting of PhD graduates.
5. The research groups of the Montegancedo ICE have increased greatly the **contracting per work and service of pre and post doctorate engineers and researchers associated with the research projects** promoting the added value of the ICE as a generator of quality employment. The contracting of researchers in the centres in Montegancedo ascending at the beginning of 2013 to exceed 300 distributed in research centres and the *ETSI Informáticos* as follows:
 - a. CIDA (IDR): 20
 - b. CIDA (USOC-E): 9
 - c. IMDEA Software: 50
 - d. CTB: 34
 - e. CBGP: 80
 - a. COM: 18
 - b. CEDINT: 43
 - c. CESVIMA: 10
 - d. ETS computer engineers: 94

9.2. Adaptation to the European Higher Education Area

In recent years the UPM has culminated the adaptation of its qualifications and learning models to the Bologna Process. In the case of the Montegancedo ICE, this process has meant the renovation of undergraduate and Masters' degree qualifications offered together with the acquisition of equipment for the renovation of lecture rooms and laboratories (see figure 60).



Figure 60. Teaching laboratory at the *ETSI Informáticos*

Teaching equipment has been acquired for the ETSI informáticos and CEDINT, CTB and CBGP with resources from calls for support to the Campus of Excellence del Ministry of Education. This has allowed the research centres to have the means necessary for the imparting of Masters' and PhD Degree programs.

Table 2 shows the overall situation for students enrolled at the UPM and those enrolled at Montegancedo. It must be mentioned that as regards enrolment into PhD and Post Graduate studies in the 2008-2009 academic year none of the R&D centres on the Campus were in operation, which is why practically all of the enrolment has to be considered as from the *ETSI Informáticos*.

Likewise, it has to be mentioned that although in Montegancedo enrolment in the 1st and 2nd year for undergraduate and official Masters' Degree courses decreased in the 2011-12 academic year in respect to the 2008-09 academic year. However, enrolment in PhD and Postgraduate has increased in this 2012-13 academic year, a symptom of the attractiveness of the R&D Centres of the Campus, especially for foreign students, whose percentage went from 12.36% to 21.08%.

Evolution of strategic objectives of ICE Montegancedo

	1y2 Ciclo, Grado y Master Oficial	Doctorado y Posgrado	Total
Matriculados 2008-09	37.285	3.280	40.565
Extranjeros 2008-09	2.070	820	2.890
% Extranjeros 2008-09	5,55%	25,00%	7,12%
Matriculados Montegancedo 2008-09	2.232	196	2.428
Extranjeros Montegancedo 2008-09	204	96	300
% Extranjeros Montegancedo 2008-09	9,14%	48,98%	12,36%
Matriculados 2011-12	38.566	3.689	42.255
Extranjeros 2011-12	3.173	844	4.017
% Extranjeros 2011-12	8,23%	22,88%	9,51%
Matriculados Montegancedo 2011-12	1.592	234	1.826
Extranjeros Montegancedo 2011-12	282	103	385
% Extranjeros Montegancedo 2011-12	17,71%	44,02%	21,08%

Table 2. Students enrolled at the UPM and Montegancedo. 2008-2009 and 2011-12 Academic years

9.3 Promotion of the Masters' and PhD Degree programs

The PhD Degree programs related to the Montegancedo ICE (in some cases the impartation is total and in other cases partial with the implication of different schools at the UPM) which have achieved the recognition of PhD Degree with **the Seal of Excellence** are as follows:

1. At the ETSI Informáticos
 - a. PhD in Advanced Computing for Science and Engineering Co - the Seal of Excellence (in with the CeSViMa)
 - b. PhD in Artificial Intelligence - Seal of Excellence
 - c. PhD in Software and Systems - Seal of Excellence (with the collaboration of IMDEA Software through the definition of the lines of research within the PhD and participation of IMDEA Software researchers within it).
 - d. A new proposal of a PhD programme on Software, Systems and Computing (in assessment by the ANECA at the moment) in collaboration with the Instituto IMDEA Software by defining of research lines and with the participation of researchers of institute.
2. At the CBGP
 - a. PhD in Biotechnology and Genetic Resources of Associated Plants and Microorganisms - Seal of Excellence
3. At the CEDINT
 - a. PhD in Photovoltaic Solar Energy - Seal of Excellence
 - b. PhD in Communications Technologies and Systems - Seal of Excellence
 - c. Participation in the Master's Degree in City Sciences (coordinator from the ETSAM)
4. At the CTB
 - a. PhD in Biomedical Engineering - Seal of Excellence

5. At the CIDA
 - a. PhD in Aerospace Engineering - Seal of Excellence

Likewise, an effort is being made to widen the range of **official Masters' Degree programs**, coming into effect in the 2013 academic year and is as follows:

1. At the **ETSI Informática**
 - a. University Masters' Degree in Advanced Computing for Science and Engineering
 - b. University Masters' Degree in Software Engineering
 - c. University Masters' Degree in Computer Engineering
 - d. University Masters' Degree in Artificial Intelligence
 - e. University Masters' Degree in Software and Systems (with the collaboration of IMDEA Software its itinerary).
 - f. Development of the Masters' Degree in Computer Engineering at the *ETSI Informáticos*. It's coming into effect is envisaged for the 2014-2015 Academic year.
2. At the **CBGP**
 - a. University Masters' Degree in Agro-forestry Biotechnology
 - b. Erasmus Mundus: "*Plant Virology in the new era-breeding for resistance*" (BRAVE) Coordinator by the University of Athens, Greece, involves 7 universities from 7 European countries and 4 universities from India.
3. At the **CEDINT**
 - a. University Masters' Degree in Photovoltaic Solar Energy
 - b. University Masters' Degree in Communications Technologies and Systems
 - c. This range will evolve with new Masters' and PhD Degree courses. CeDinT-UPM in "*Applied ICTs for Industry*", likewise the Masters' Degree in Smart Home Technology and the Digital Home.
4. At the **CTB**
 - a. University Masters' Degree in Biomedical Engineering
 - b. Preparation for a Masters' Degree in "Translational Research" promoted by the CTB together with the UAM and the University of Colorado. It's coming into effect is envisaged for the 2014-2015 Academic year.
5. At the **CIDA**
 - a. University Masters' Degree in Aerospace Engineering (two subjects from the Masters' and PhD Degree in Aerospace Engineering carry out work experience at the facilities for experimental aerodynamics at the IDR (CIDA).
6. At the **ETSI Informáticos** and **IMDEA-Software**
 - a. Preparation for a Masters' Degree related to the Spanish node of the KIC of the ICT-Labs of the European Institute of Technology and Innovation (EIT).

9.4. Training in Entrepreneurship

The program for the *actúaupm* Creation of Businesses has been consolidated as a fundamental program of the entrepreneurship activity at the UPM. 405 teams have been presented at the 10th edition of which 184 have gone on to the second phase and 136 have access to the first formative phase (3 groups)¹⁹. 47 teams participate in the experts and business-Lab program.

The results achieved in this program have allowed 138 businesses to be created to date (10 new businesses created with the period January – July 2013) with a survival rate of 84% in the third year. These businesses have obtained €28M since 2007 in different rounds of financing.

Beyond these results in the creation of technology-based businesses highlights the effort made in the training in entrepreneurship. Figure 61 details the type of courses carried out at the CAIT during the years 2012 and 2013 through the *actuaupm* program (in relation to the drawing up of business plans) and *innovatech* (in relation to the commercialisation of technologies). The second edition of the Commercialisation Course is envisaged for October 2013.

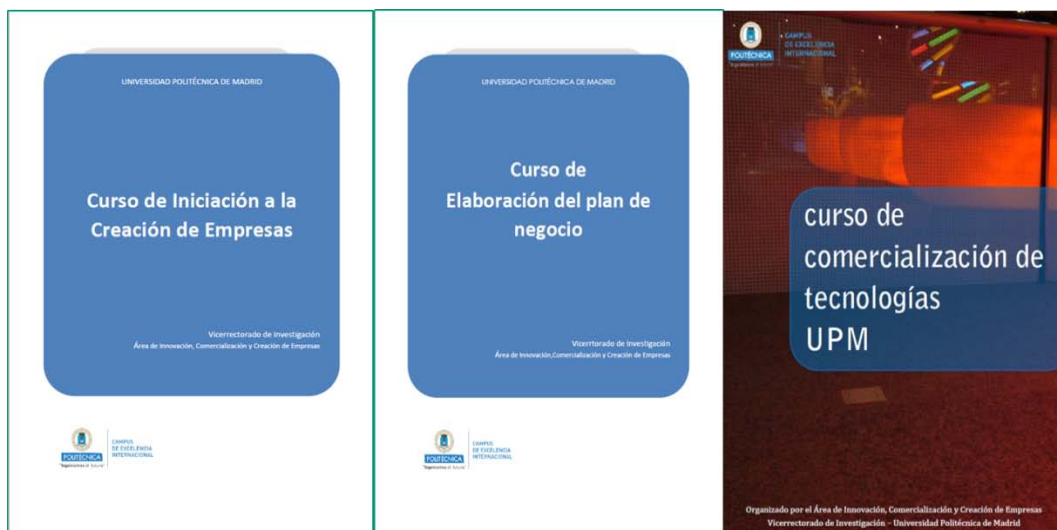


Figure 61. Training linked to entrepreneurship coordinated from the CAIT

With the objective of facilitating the training of new teams in the creation of businesses a “Space for Entrepreneurship at the CAIT” has been set up associated with the students participating in the *actuaupm* ideas program in the form of a pre-incubator of business project. The pre-incubator will be installed in 2013.

¹⁹ Of the 221 team eliminated, 109 will be invited to a repeat and preparation program for the 11th Competition

10. Interaction between the Campus and territorial environment

Different activities have taken place in this area:

1. Organization of International Conferences and Seminars:

A specific activity has taken place in 2013 to hold different international conferences and seminars on the Montegancedo Campus to increase the visibility of the Montegancedo ICE in the area of research. Specifically the following international activities have taken place or are programmed:

- a. 31 January and 1 February 2013 (CBGP): *New Frontiers in Plant Biology*
 - i. 14 invited speakers,
 - ii. 170 participants
- b. 3-7 June 2013 (CTB): *XXXIII Dynamic Days Europe*
 - i. 20 invited speakers,
 - ii. 300 participants
- c. 29-30 August 2013 (CBGP): 3rd EWPC (*European Workshop on Plant Chromatin*)
 - i. 2 invited speakers
 - ii. 98 participants
- d. 17-19 October 2012 (co-organized by the CeDinT and the ETSI Informáticos of the UPM): 4th JVRC (*Joint Virtual Reality Conference*)
 - i. 5 Invited speakers
 - ii. 114 Participants
- e. 4 December 2013 (CAIT): 1st International *Workshop on Innovation and Entrepreneurship*
 - i. 8 invited speakers (estimated)
 - ii. 80 participants (estimated)

Figure 62 includes the posters for the conferences held at the Montegancedo Campus partially financed by the Campus of International Excellence Program.



Figure 62. Posters for “Dynamics Days Europe”, “JVRC” and “EWPC”

2. ‘Open Doors’ days. Science Week 2011

Within the framework of the Science Week from the Madrid regional Government which takes place annually around the month of November, the *Facultad de Informática* organised ‘Open Doors’ days aimed at secondary education students, of the ESO and Baccalaureate.

The objective of these days is to disseminate the research carried out at the Faculty, also offering the possibility of getting to know the facilities and daily activity of the campus. It took place on the 17 and 18 of November 2011, with a duration per visit of 2 hours and a maximum of 30 people.

Part of the visit included a tour of the Museum of Computer History, as well as the singular research facilities of our Campus.

3. The Museum of Computer History

The *Facultad de Informática* (ETSI Informaticos) had a Museum located in the Lecture hall of Block 5, which houses a collection of more than 80 objects of special relevance in the history of computing and communications. It has a maximum capacity of 30 people.

A total of 442 secondary school, Professional Training, and Baccaureate students from 18 different education centres of the Madrid regional Government visited the Museum in 2011.

4. Summer School Campus

The objective of this activity is to give students from the 4th year of ESO and the 1st of Baccaureate an approximation of university life and scientific activity. They carry out science-related projects led by university teachers and researchers together with secondary school teachers.

The projects developed for the students have a common component of the subjects available on the Campus: The TIC, applied to different fields such as the simulation of environmental scenarios, experimental aerodynamics, biotechnology and the modelling of virtual environments. Likewise, the TIC are used for the development of oral communications skills of the students through a self-evaluation of the work carried out which allows them to integrate the knowledge acquired within a wider framework for the integral development of the student. This is in spite of the learning of technical subjects linked to engineering with the development of transversal skills in all scientific fields.

5. Web site of the Montegancedo ICE

The development of the Web site of the Montegancedo Campus, Campus of International Excellence has been designed for users who would be potentially interested in forming part of the Campus, be it as students or researchers. Creating a simple Web page with an ordered and balanced content allows the user to access the information easily and intuitively.

The Web site is hosted in a server at the *Universidad Politécnica de Madrid* whose domain name is: www.upm.es/Montegancedo

The final objective of the Web site is the presentation of a dynamic Web portal that shows up-to-date information and subsidiary and content linkable to the Web of the *Universidad Politécnica de Madrid* (see figure 63).

The Montegancedo Campus is committed to internalisation and it is for this reason that all of the information on the web is in both Spanish and English, all of the activities, news and

agenda appears in both languages. The web content has been distributed in several sections so that the user is able to find the information that he or she needs.



Figure 63. Home page of the Montegancedo Campus web portal

Developed and fostered from the CAIT the “**R&D&I Observatory of the UPM**” (developed by the Vice-Rectorate for Research of the UPM) **has been extended with** information relative to aspects of “**technological innovation**” in which the range of the UPM is outstanding. In this sense, there are some specific pages for obtaining information relative to innovation in Spanish and English (see figure 64).

The information corresponding to the range of the UPM has been classified thematically (not by centre or school from which the Research Group who developed it comes from) thought out for greater ease of use of the external user.



Figure 64. Technological observatory

This external visibility is also linked to the international recognition that the E-USOC team has obtained from the European Space Agency (ESA) for its work and the GEOFLOW-2 experiment carried out on the International Space Station. Figure 65 highlights this fact.



Figure 65. Awarding of recognition to the UPM (E-USOC) represented by Ana Laverón (Director of the Centre) in March 2013

This recognition has also been specified in the recognition awarded to Professor Juan Carlos Miñano from CEDINT in the “A.E. Conrady Award” from SPIE (International Society of Optics

and Photonics) for their work on High Performance Photovoltaic Concentration Cells (see figure 66).



Figure 66. Recognition of Juan Carlos Miñano

Finally, an effort has been made to improve the general exterior signposting of the Campus by means of the placing of a general panel at the entrance to the Campus (from the M-40), and the installation of panels on stands outside all of the centres. Figure 67 shows the information in the case of the Business Centre.

A large informational panel for the Business Centre at the University of Madrid. At the top, it features the university's logo and name: 'UNIVERSIDAD POLITÉCNICA DE MADRID CAMPUS DE EXCELENCIA INTERNACIONAL MONTEGANCEDO PARQUE CIENTÍFICO Y TECNOLÓGICO'. Below this, the title 'CENTRO DE EMPRESAS' is prominently displayed. The panel includes a map of the campus with various buildings labeled, such as 'CAIT', 'VIVERO DE EMPRESAS', 'INDIA SOFTWARE INSTITUTE', 'ETS DE INGENIEROS INFORMÁTICOS', 'ETS DE INGENIEROS TÉCNICOS', 'CENTRO DE INVESTIGACIÓN Y DESARROLLO AEROSPAZIAL (CIDA)', 'OBGP', and 'Cañales'. To the right of the map, there are two text boxes. The first box is for 'CENTRO DE APOYO A LA INNOVACIÓN TECNOLÓGICA (CAIT)' and 'CENTRE FOR SUPPORT FOR TECHNOLOGICAL INNOVATION (CAIT)', describing its mission and providing a QR code and website. The second box is for 'VIVERO DE EMPRESAS' and 'BUSINESS INCUBATOR', describing its services and providing another QR code and website. The panel also includes logos for 'INNOVATION' and 'CAMPUS DE EXCELENCIA INTERNACIONAL POLITÉCNICA'.

Figure 67. Information installed on stands at the entrance of each building on the Campus (image corresponding to the Business Centre)

11. Envisaged future evolution

The **Strategic Plan** conceived for the development of the **Montegancedo Campus** in 2009 as a **International Campus of Excellence** was drawn up under very different national and international financial conditions for that in which we are going through at present. This situation, which is profoundly effecting the budget available to the public system, both in the calls from the National Plan for Research and the financing of universities from the Autonomous Regional Governments (The Madrid Regional Government in the case of the UPM) has required the UPM to have to **adapt the rhythm of the development of the ICE** to the current economic resources available without altering the essence of its strategic objectives.

The two main **consequences** deriving from this situation are as follows:

1. Slowing down of some of the initially envisaged activities

- a. Construction and putting into effect of a **Residence for students and teachers**
 - i. The tender for the adjudication of this Residence by means of administrative concession is pending the definitive agreement of the Council of *Pozuelo de Alarcón* of a modification of the initially existing residential area so as to locate it in the centre of the CEI.
 - ii. It is expected the tender for the administrative concession for a residence of 100-120 places could be called and resolved in 2014 and that the residence will be operative at the end of 2015 or the beginning of 2016.
- b. Setting up of a PhD School
 - i. This activity is subject to approval by the governing bodies of the UPM of the PhD School of the UPM (or several of them if it is so decided) for there to be a seat in Montegancedo. It is expected that the school will favour the internationalization of the PhD students, as detailed later on.
 - ii. It is not wished that the placing of this seat to be independent of the overall management of it or the PhD schools of the university but that a solution is adopted based on the large areas of sub-seats in deferent campuses. It is expected that the decision of the UPM will be taken during 2013.

- iii. The PhD programs related to the R&D centres and the *ETSI Informáticos* on the Campus will be fostered with a great increase in the recognition of the programs of excellence.

2. Elimination of some of the previously envisaged activities

- a. Project for the complete re-urbanisation of the CEI
 - i. The initial proposal contemplated a project of re-urbanisation with a central hub. Its elevated cost means that it cannot be carried out at the present time. The UPM will, nevertheless, undertake the specific improvement work possible within the budgetary restrictions.
- b. Construction of a Research Centre for **construction technologies**
 - i. Its elevated cost means that it cannot be carried out from the budget of the UPM itself, and the situation of the construction business sector in our country has made it impossible to reach an agreement for its complete financing. The project, although it very probably will not be carried out within the remaining period until 2015, has allowed the putting into effect of two activities linked to the construction sector:
 - 1. Location of the CIESP in the new bigger building of the Business Centre.
 - 2. Installation of the houses fuelled by photovoltaic solar energy as a “solar hamlet” which allows its suitable location for the demonstration of new energy efficient construction technologies.

From a **more overall point of view**, we think that to be able to manage to develop the Montegancedo Campus, a medium-term strategy for the next few years will be necessary to achieve the following **essential objectives**:

- 1. **Increase the number of students** at the Montegancedo ICE, fundamentally in Masters’ and PhD Degrees that will attract researchers in training associates with the research centres located on the Campus and the ETSI Informáticos.
 - a. For this, it is aimed to reach agreements with the entities allied to the Campus for the co-financing of calls for Research staff in training (PIF) associated with the R&D agreements with each of them. It is expected that a COFUND proposal will be presented within the H2020 calls from 2014.

- b. This action will be boosted by the actions associated to the Spanish node of ICT-Labs, which includes the carrying out of Masters' and PhD Degree programs as part of the general strategy in connection with other universities, research centres and European technological businesses, which is expected to increase the internationalization of the campus as a consequence²⁰.
2. Increase the number of **research or technological centres in conjunction with other public or private entities** which will make the research activity more dynamic.
 - a. Special attention will be paid to the creation of technological centres in conjunction with the private sector after the approval of the Governing Committee of the UPM of the regulation to that effect in 2011. Once the *Centre for Open Middleware* is developed, it is expected to create joint units with the business sector.
 - b. Setting up of the **CIESP-FabLab**. On the assumption that the creation of the centre as a mixed centre with the UCM is delayed, the UPM will undertake its approval as its own centre independently of its future conversion into a mixed centre. The Fab-Lab will be integrated into this subject.
 - c. Creation of a new research centre generated from **CeSViMa** with the participation of the teaching of researchers at the Schools of Aeronautic, Telecommunications, Mining, Industrial Engineering, and the Complutense (UCM) and Rey Juan Carlos (URJC) Universities. This process is being carried out in a formal process within the UPM. It is expected that it could be approved by the Governing Committee at the end of 2013.
3. Establish **close relationships with the ICE Moncloa and the other campuses of the UPM** (specifically Campus Sur and Tecno-Getafe).
 - a. As regards the ICE Moncloa, there is an agreement between both entities (UPM and UCM) to support the joint use of infrastructures (it is to be highlighted that the installation of a magneto-encephalography system in the joint UPM-UCM laboratory at the CTB has used the chamber that previously existed in the UCM) from the Montegancedo ICE.

²⁰ The commitment to participation from 2014 in the International PhD School of the KIC of ICT-Labs assumes the need to incorporate a minimum of 6 PIF contracts annually until reaching a permanent staff of 24 contracted PhD Degree students (the maximum would be 10 annually which would be a total permanent staff of 40).

- i. For this, coordination systems will be established through governance schemes and the CAIT in those aspects related to technological innovation.
 - b. Especially relevant will be the creation of a research centre jointly with the UCM in Heritage, CIESP, as previously mentioned.
4. Develop around the Montegancedo ICE a **technological ecosystem of open innovation** to promote the installation of small businesses (spin-offs of the UPM or not) to accelerate the commercialisation and exploitation of R&D results in close interaction with the research centres located on the Campus. Specifically, two activities in 2013 are undertaken:
 - a. Setting up of a **COM ecosystem**. Software development businesses linked to the open platform that the Centre for Open Middleware (COM) is developing. These businesses will be developed around the **actúaCOM** initiative arising from the **actúaupm** program but linked to the interests of COM.
 - b. Setting up of a Spanish node of **KIC-ICT Labs** which in turn implies the commitment to developing different technology-based businesses in the context of Masters' and PhD Degree schools.
 - c. Increasing joint activities with aggregations or with other parties interested in increasing their relationships with the UPM. In this sense it is aimed to set up the **"Innovatech Club"** as a forum for meetings between the researchers and those responsible at the UPN in the Montegancedo ICE, aggregations and the private sector.
5. Complete the setting up of **scientific infrastructures of the Campus** whose objective is that they continue to be an element of attraction for the research activity in the centres and ETS del Campus, specifically:
 - a. The objective is that the **photovoltaic concentration energy demonstrator**, which is currently in the implementation stage, will come into operation at the end of 2013.
 - b. The **intelligent illumination demonstrator**, which is currently in the implementation stage, will be operative at the end of 2013. This will allow the Campus to propose its use for demonstration packets of the "City of the

- Future” (strategic institutional initiative of the UPM) together with some collaborating entities.
- c. It is expected that the **P3 Laboratory for biological security** for the CBGP (pending final permission) will come into operation at the end of 2013. With this the most advanced laboratory designed for the manipulation of plant pathogens will be available.
 - d. Putting into effect of the plan for the **conversion of the refrigeration system of the CeSViMa to a “Free-Cooling” system**. The objective is to achieve a reduction in electricity consumption by an additional 40% with which the envisaged investment will be recovered in the same year.
 - e. The contracting of the **animal house unit for the CTB** whose installation is envisaged for 2014 will take place in the latter part of 2013. This will provide a modular storage and mouse manipulation system which could be extended if necessary and would allow experimentation on animal project to be undertaken.
6. Increase in the participation in **large international research projects** which serve as tractors for the development of other linked projects.
- a. The **“Human Brain”** FET Flagship project which with the continuation of the Blue Brain project will commence in October 2013. It would suppose the availability of a team of 65 people in the project which would make it one of the largest volume projects in the public system in our country. It is expected that diverse agreements around it will be signed with the private sector with the objective of completing the activity with projects oriented to neurological illnesses or simulation.
 - b. The laboratory phase of the NFIX project, financed by the *Bill & Melinda Gates Foundation* has started. Its objective is to generate technology to obtain cereals with less dependency on nitrogen fertilizers. As well as its economic importance in intensive European agriculture, this project is a humanitarian contribution of the UPM to small farmers in Africa and Southeast Asia.
 - c. The recent signing of a Joint Research Unit (**JRU**) of the UPM with Telefónica is going to allow joint development activities in the FI-WARE pilot to begin

(platform of future Internet) under development by the EU and from which it is expected that the Montegancedo ICE will be able to have a demonstrator.

7. **Launching of two micro satellites** designed and integrated in the UPM which allow aerospace activities to be expanded on the Campus.
 - a. **UPM SAT-2** whose launch is envisaged for 2014 as a secondary load together with the Spanish INGENIO observation satellite.
 - b. **UPM Cube-SAT** demonstration satellite adjudicated to Spain by the European Commission (financed through the FP7). Its launch is envisaged for 2014.

The development of these objectives is practically **guaranteed with the resources currently available** so its achievement is not going to depend on a substantial change in the economic situation.

It is clear, however, that many other initiatives that might arise are going to require additional resources therefore a transversal objective in the Campus will be the generation of additional resources, mainly from the national and international private sector. To this end some of the initiatives designed to know what to do and what can be done on the Montegancedo ICE are especially relevant.

12. Conclusions

The aim of this 2013 report is to offer a general panorama of the evolution and achievement of the **strategic objectives for the development of the Montegancedo ICE** contemplated in the initial proposal. The **files** that accompany this document, the Web page of the Campus and the documents referenced in Annexe 3 will allow the details of each of the activities to be known. Table 3 schematically summarises the large figures achieved in the Campus.

Centre or unit located on the Montegancedo ICE	Investment in Infrastructure made * (€M)		Number of researchers (staff, post-docs)		Nº of Masters' and PhD Degree students		Agreements with aggregations
	2005-2011	2009-2013	2009	2013	2009	2013	
ETSI Informáticos*	1,6	0,1	203	262 (170 PDI)	378	375	1

Evolution of strategic objectives of ICE Montegancedo

CEDINT	8,6	0,6	24	27	137	238	2	
COM	1	-----	0	50	0	0	3	
CBGP	12,8	0,8	50	78	74	44	2	
CTB	11,7	1,6	32	47	73	92	4	
IMDEA Software	10	13	17	29	9	17	4	
CIDA-IDR	2,5	0,2	19	29	153	184	2	
CIDA-USOC-E	0,2	----	----	----	----	----	1	
CESVIMA	2	2,7	8	12	----	----	1	
CAIT		5,7	----	----	----	----		
Centro de empresas	5	---	----	----	No aplica ble			
TOTALES*	55,4	24,7	353	534	824	950	20	

* The data correspond on the one hand to UPM investment 2005-2009 and on the other hand the investment made with ICE financing 2009-2011

** Since June 2013 its official name is *ETSI Informática*

Table 3. Overall evolution of the Montegancedo Campus

Table 3 offers an overall vision which gives an idea of the effort made in a very short period together with the positive evolution that the Campus has gone through. Altogether, the UPM and the aggregations have made investments of more than €600M in just seven years. A very relevant effort in the whole of the UPM and that of the allied public entities in a complex economic situation such as that we are currently going through.

For the correct interpretation of the table it must be borne in mind that the Montegancedo ICE is not isolated from the whole of the UPM and for this reason, in some indicators a complete separation in the activities of the Montegancedo ICE and in total of the UPM do not make

Evolution of strategic objectives of ICE Montegancedo

sense. Some of the units on the Montegancedo ICE have been designed to provide a service to the whole of the university. Annexe 1 (Summary of the key indicators) develops these indicators in great detail and complements them with others that seem especially relevant in accordance with the strategic objectives of the CEI.

Table 4 summarises the evolution of the four years that have passed since the proposal presented in September 2009 to date. The annual payments 2010, 2011, 2012 and 2013 (up to July) have been considered in the activities²¹.

Annual payment	2010	2011	2012	2013
Type of activity				
Teaching				
New undergraduate programs (year of creation)	Biotechnology Biomedical engineering			
New postgraduate programs				Masters' Degree in Computer Engineering Masters' Degree in "City sciences"
International PhD Degree School			Erasmus Mundus	KIC ICT-Labs PhD Degree program
Training towards entrepreneurship	7 th Creation of businesses	8 th Creation of businesses	9 th Creation of businesses 1 st Course in the Commercialisation of technologies	10 th Creation of businesses 2 nd Course in the Commercialisation of technologies
Research				

²¹ It has been preferred to generate this table regardless of the detailed information contained in the activity files which are presented as an Annexe to this report.

Evolution of strategic objectives of ICE Montegancedo

R&D centres created on the Campus	CTB CEDINT IDR CBGP	COM CIDA (IDR+E-USOC)		CESVIMA CIESP
Joint UPM-entity units	Elekta T-Systems CIBERbbn	CSIC UCM	COM URJC Hospital Puerta de Hierro Telefónica (JRU-IMDEA SW)	Telefónica (JRU-UPM)
University – business chairs	Clarke & Modet FDI			eGauss (substituting FDI)
Innovation				
Commercialization	Marcelino Botín Foundation		AJ Calero	Plant Response
Agreements to support technology licences			e-Gauss Plant Response	Calero AJ Clarke & Modet
Putting into effect of living labs and demonstrators	Efficiency	Solar dwellings	TV-3D	Spaces of the future intelligent Illumination Photovoltaic demonstrator Bank of the Future
Spin-offs generated on the Montegancedo ICE	15 5 CEI	17 6 CEI	17 7 CEI	10 (up to 30 June) 4 CEI
Internationalization				

Evolution of strategic objectives of ICE Montegancedo

R&D agreements signed with non-Spanish entities	Université du Toulouse (France)	University of Colorado (Denver, USA) Universidade Campinas (Brazil)	Julich Centre	CNR (Florence) UCB Pharma Philips ICT-Labs-EIT Frontiers-Nature ETH Zurich Roskilde U.
International Congress and Workshops			4 th JVRC	XXIII Dynamic Days 3 th Plant Chromatin 1 st Innovatech
Improvements to the Campus				
Additional car parking spaces	30 (CTB)			30 at the CAIT 25 exterior
Accessibility and security		Barriers to entry		Biometric identification
Signposting	Sign panels on the M-40			Informative panel Information stands
Relationship with the socioeconomic environment				
Summer school	Sí (20)	Sí (20)	Sí (20)	COM (10) Camping
Science week	Yes	Yes	Yes	Envisaged

Evolution of strategic objectives of ICE Montegancedo

Spin-offs housed in the ICE with R&D agreements	LPI Algenex	Artificial vision		e-Commerce Frontiers
CEI Reception office	Faculty of Computer Engineering			CAIT ETSI Computer Engineering
Museum	Museum of Computing			
Governance				
Advisory Council of the CEI			Creation of the Advisory Council	Advisory Council Work Groups “International Advisory Board” (CAIT)
Entities allied to R&D centres	LPI T-systems	CSIC UCM URJC	Hospital Ramón y Cajal	Vivaki Communications SLU y Mimétrica SL (in process)
Delegate of the Rector	Vice-Rector for Research	Vice-Rector for Research	Vice-Rector for Research	Deputy Rector for strategic programs

Table 4. Summary of the key landmarks in the evolution of the activities at the Montegancedo

ICE

As this report demonstrates, **a large part of the strategic objectives proposed by the UPM in the initial proposal of the I2Tech project have been achieved** through which demonstrating the validity of the institutional commitment made. Although it is clear that the financial crisis has meant a slowing down of the implementation of activities that imply large investments, the carrying out of new activities not contemplated in the initial proposal of the ICE have also been made possible and in line with the general objectives of taking advantage of new opportunities in collaboration with the private sector.

As regards the **2012 Progress Report**, evaluated positively by the International Commission, it must be noted that the only observation made as regards the finalization of some of the activities pending is that it was achieved in spite of the complex economic framework that has had to be generated.

In short, we find ourselves before a **Campus, original in its conception, promoting an international excellence based on technological innovation, promoting alliances with private entities, incorporating one of the seats of the UPM Park, and developing harmoniously with an area of natural beauty in the upper basin of the River Manzanares.**

The period covered from 2009 to date has been very important for the Campus. In the next three years (up to December 2015) priorities are going to be oriented to the **consolidation of the activities put into operation**. The bases have been put into effect and there is the political will to incorporate it.

We are aware that there is still much to do. The challenges that face our country, and therefore, its public universities as well demand imagination and effort to achieve the desired objectives. In our case, the desire is to have a close interaction with aggregations. We are determined to achieve it.

Annexe 1: Summary of key indicators for the Montegancedo ICE

Indicador	2009		2011		2012 y 2013		Commet
	Totales	CEI	Totales	CEI	Totales	CEI	
UPM publications in JCR journals	1,348	79	1564	144	1.321	216	Data 2012
Nº of research centres or technological	8	3	13	4	12	6	Without counting the Faculty or the USOC
Nº of international projects obtained	61	21	72	18	155	35	Taking to account the main researcher. Data 2012 y 2013
Costs of international projects obtained	9.961.660	4.497.682	19.533.618	6.885826	23.391.814	10.590.953	Taking to account the main researcher. Data 2012 y 2013
Costs of projects with companies	56.058.699	11.156.096	48.816.316	6.855.350	30.075.606	5.460.548	Data 2012
Official Undergraduate students	37.285	2.232	38.566	1.592	37.838	1.658	Year 2012-2013
Master's degree students	3.280	196	3.689	234	3.453	210	Year 2012-2013
PhD graduated incorporated	105	14	166	16	196	22	Year 2012
Research staff in training	437	22	504	47	550	64	PIFs with a grant or official contract
Phd students	3.280	196	3.689	234	3.453	830	Year 2012-2013
Number of PhD theses read	203	20	117	15	249	31	Year 2012-2013
% non Spanish students	7,12%	12,36%	9,51%	21,08%	24,04%	49,52%	Year 2012-2013
Patents conceded by the OEPM to the UM	25		39		50		UPM total data 2012

Evolution of strategic objectives of ICE Montegancedo

International extensions	44	81	66	Total UPM data 2012
Patents licensed	29	57	72	Total UPM data 2012
Spin-offs businesses created	15	17	17	Total UPM data
University – business chairs	81	84	81	Total UPM data 2012
Total R&D contracting	45,96	44,04	38,26	It is not possible to divide/ Just Art. 83 and Foundations signed per year
Accumulated investment*	55,4	11,4		The initial construction of the ETSI Informáticos is not considered

* Some of the data in this column refer to the year 2012

** The data correspond on the one hand to UPM investment 2005-2009 and on the other hand the investment made with ICE financing 2009-2011

Annexe 2: Key associated documentation

Fundamental reference documents corresponding to Montegancedo ICE which complement this report are detailed below.

1. I2Tech. 2009 Project, Final proposal
2. 2012 Report Montegancedo ICE. UPM. September 2013.
3. Report on the CEI-Montegancedo situation. UPM May 2013.
4. Activity Files 2013 corresponding to the Montegancedo ICE 2013 Report. UPM. September 2013.
5. Vice-Rectorate for Research. "Objectives and structure of the Support Centre for Technology Innovation". Governing Committee of the *Universidad Politécnica de Madrid*. October 2012.
6. Gonzalo León, Francisco del Pozo, Javier de Felipe and Fernando Maestú: *La ingeniería al encuentro de las neurociencias: experiencias de una simbiosis interdisciplinar*. Tribute to López Ibor. 2013
7. Gonzalo León: The commitment to research at the UPM: commitments and results at the Montegancedo Campus. May 2013.
8. Gonzalo León: The experience of the Technical University of Madrid in the Spanish programme of International Campus of Excellence (ICE). Bucharest. Springer Verlag (2013) (being printed).
9. Gonzalo León et al. How to build the Technical University of Tomorrow. White Paper ULAB project. ISBN: 978-84-695-7624-3. January 2013. <http://www.ulab-fp7.eu/images/stories/misc/publicdeliverables/whitepaper-howtobuildthetechnicaluniversityoftomorrow.pdf>
10. Gonzalo León: Montegancedo ICE 2020: Looking to the future. May 2013.
11. Gonzalo León: The role in strategic alliances in the positioning of public universities. Strategic Alliances Course. Castellón. 2012.
12. Gonzalo León: Analysis of university-driven open innovation ecosystems: the UPM case study. August 2013.
13. Rebecca Allinson, Kincsö Izsak, Elina Griniece (Technopolis group): Catalysing innovation in the knowledge triangle: practices from the EIT knowledge and innovation communities. European Institute of Innovation and Technology. June 2012
14. UPM Catalogue of technologies and solutions. Support Centre for Technology Innovation. UPM. Julio 2013.
15. CTB 2012 Report
16. CBGP 2010-2012 Report
17. CEDINT 2012 Report
18. IDR 2012 Report
19. IMDEA Software 2012 Report
20. CESVIMA. 2012 Report
21. Faculty of Computer Engineering Report

Annexe 3: Aggregations

1. Accenture
2. ATOS
3. BGC
4. Clarke&Modet
5. CSIC
6. Elekta
7. eGauss
8. IBM
9. IMDEA Software
10. INDRA
11. INIA
12. ISBAN
13. LPI
14. Plant Response
15. Produban
16. Santander
17. Telefónica
18. T-Systems
19. Zeiss

Annexe 4: List of acronyms

1. AGE: Administración General del Estado
2. AAPP: Administraciones Públicas
3. CAIT: Centre de Apoyo a la Innovación Tecnológica
4. CBGP: Centre de Biotecnología and Genómica de Plantas
5. CA: Comunidad Autónoma
6. CM: Madrid Regional Government
7. CCAA: Comunidades Autónomas
8. CDTI: Centre para el Desarrollo Tecnológico Industrial
9. CEDINT: Centre de Domótica Integral
10. CEI: Campus of International Excellence
11. CESVIMA: Centre de Supercomputación and Visualización de Madrid
12. CIDA: Centre de Investigación and Desarrollo Aeroespacial
13. CNR: Consiglio Nazionale de Ricerca
14. COM: Centre for Open Middleware
15. COST: Cooperation in Science and Technology
16. CSIC: Consejo Superior de Investigaciones Científicas
17. CTB: Centre de Tecnología Biomédica
18. EEES: Espacio Europeo de Educación Superior (EHEA)
19. EEI: Espacio Europeo de Investigación (ERA)
20. EHEA: European Higher Education Area
21. EIT: European Institute of Technology and Innovation
22. ERA: European Research Area
23. ESA: European Space Agency
24. E-USOC: User Support and Operation Centre
25. FET: Future and Emerging Technologies
26. FP7: 7th Framework Programme
27. HBP: Human Brain Project
28. H2020: Horizon 2020
29. IBM: International Business Machines
30. IDR: Instituto Universitario de Microgravedad "Ignacio da Riva"
31. IMDEA: Instituto Madrileño de Estudios Avanzados
32. I+D: Investigación and Desarrollo
33. R&D&I: Investigación, Desarrollo and Innovación
34. JCI: Journal CIDAtion Index
35. JRU: Joint Research Unit (Unidad Conjunta de Investigación)
36. KIC: Knowledge and Innovation Community
37. LL: Living Lab
38. MECD: Ministerio de Educación, Cultura and Deporte
39. MINECO: Ministerio de Economía and Competitividad
40. MoU: Memorandum of Understanding
41. OEPM: Oficina Española de Patentes and Marcas
42. OPE: Oficina de Proyectos Europeos

- 43. OPI: Organismo Público de Investigación (PRO)
- 44. OTRI: Oficina de Transferencia de Resultados de Investigación
- 45. PIF: Research personnel in training (Personal Investigador en Formación)
- 46. PM: Framework Programme (Programa Marco)
- 47. PN: National Plan (Plan Nacional)
- 48. UE: European Union (Unión Europea)
- 49. UCB: UCB Pharma Ltd
- 50. UCM: Universidad Complutense de Madrid
- 51. ULAB: University Laboratory
- 52. UPM: Universidad Politécnica de Madrid
- 53. URJC: Universidad Rey Juan Carlos
- 54. WoS: Web of Science