I2Tech- CAMPUS MONTEGANCEDO
Universidad Politécnica de Madrid

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CAMPUS
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Objectives and Structure of the Centre for Support for Technological Innovation

(CAIT)

Montegancedo CIE

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Vice-Rector for Research

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GOBIERNO DE ESPAÑA
MINISTERIO DE ECONOMIA Y COMPETITIVIDAD

GOBIERNO DE ESPAÑA
MINISTERIO DE EDUCACIÓN, CULTURA Y DEPORTE

Content

1. Introduction

1.1. General situation of R&D activity at the UPM

For many years all Spanish universities have been increasing their research activity through participation in both national and international R&D projects, as well as collaboration with the business section in projects contracted directly with companies or as a result of partnership projects of public-private collaboration programs set up by the public administrations during the last decade.

As a result of this process, the number of scientific publications from Spanish universities has grown considerably as has the number of patents registered by universities at the *Oficina Española de Patentes and Marcas* (OEMP) (Spanish Office for Patents and Brands) or their international extension. Likewise, the number of spin-off or start-up businesses generated from the business creation programs that the universities have gradually been setting up has also experienced a significant increase as is demonstrated in the figures published annually by the OTRI Network.

In the case of the **Polytechnic University of Madrid (UPM)**, this positive evolution is also evident as the data demonstrate, such as the increasing number of scientific publications included in the *Web of Science* in recent years (see Figure 1). Within a period of just eight years the number of publications registered has doubled which means a much greater rate of growth than that of other universities within our sphere. It is certain that it started out at levels in which it was possible to increase scientific output substantially.

Even more significant is that this increase has taken place without altering one of the distinctive elements of a technological university such as the UPM: cooperation with the business sector in applied research.

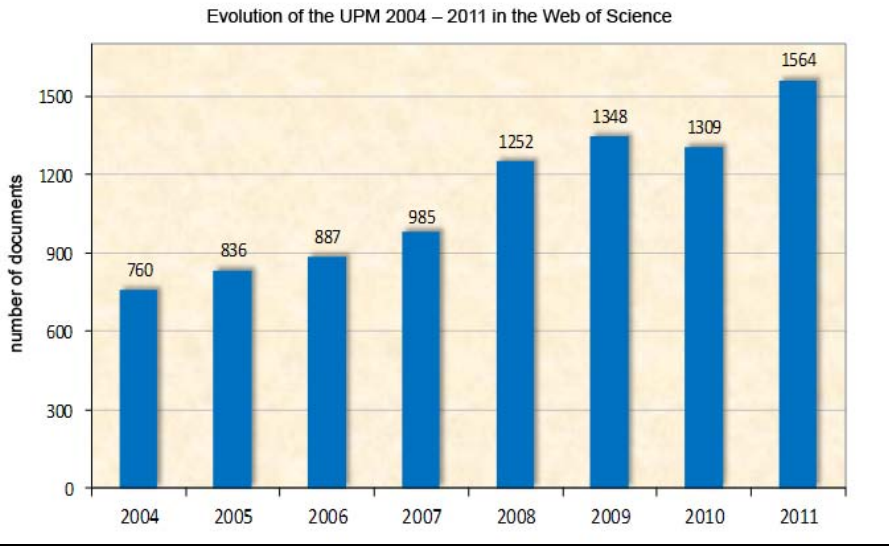


Figure 1. Evolution of the number of scientific publications

The increase in the contracting of international research projects is also relevant (fundamentally, around the R&D Framework Program of the European Union (EU)) as can be seen in Figure 2. In this case, the increase in resources at the disposition of businesses, research centres and universities within the Seventh Framework R&D Program of the EU has clearly given rise to a stimulus for this increase. In the case of the UPM, the contracting with the European Space Agency (ESA) is also relevant.

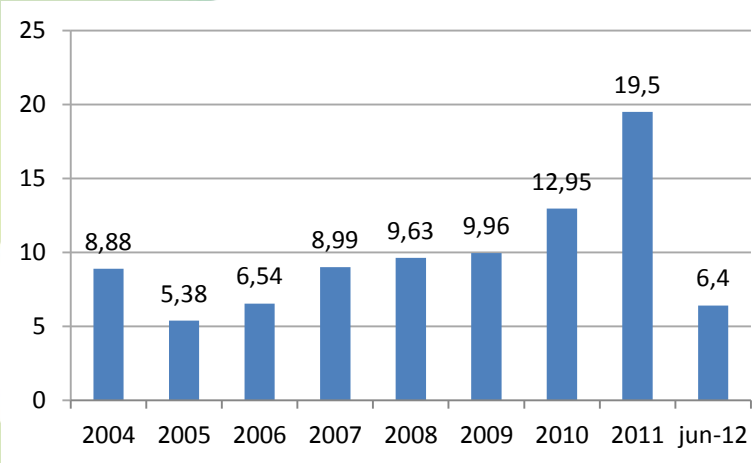
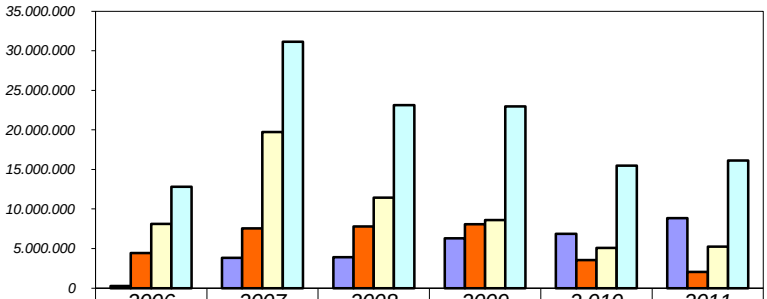


Figure 2. Evolution of the contracting with the UPM in international projects

The UPM, according to data from the *Centro para el Desarollo Tecnológico Industrial* (CDTI) (Centre for Industrial Technological Development) remains in first place as the Spanish university with the greatest number of projects. It has also obtained a greater return within the 7th Framework Program in the period 2007-2011 since its beginning.

Another piece of data that corroborates the importance of university-business collaboration in R&D activities is the evolution of applied research projects that have been financed by means of programs from the General Administration of State within the National Plan for R&D&I carried out in collaboration with the business sector. Figure 3 summarises the situation within the period 2006 to 2011[1]. These programs involve the participation in projects led by the business sector with which the university strengthens its cooperation.



	2006	2007	2008	2009	2.010	2011
MICINN: Antiguo PROFIT - Actual INNPACTO	274.234	3.815.313	3.895.711	6.295.041	6.848.245	8.854.212
MITYC: Antiguo PROFIT - Actual AVANZA	4.417.338	7.564.348	7.807.388	8.062.233	3.540.475	2.034.404
CENIT (CDTI - MICINN) - Actual INNPRONTA y Otros	8.127.310	19.741.83	11.428.55	8.602.863	5.092.742	5.222.661
TOTALES	12.818.88	31.121.49	23.131.65	22.960.13	15.481.46	16.111.27

Figure 3. Evolution of the resources obtained in public calls for university-business cooperation for the UPM

In summary, figure 4 allows us to see the evolution of the contracting of R&D activities by the UPM and its foundations in recent years.

	2007	2008	2009	2010	2011
INTERNATIONAL PROGRAMS	8.99	9.63	9.96	12.95	19.5
NATIONAL PROGRAMS	51.59	51.35	64.55	39.52	32.85
REGIONAL PROGRAMS	4.07	2.56	0.20	1.9	2.47
OTT Contracts	29.44	28.80	21.07	14.55	17.26
Foundation Contracts	26.18	24.75	24.89	26.18	26.78
R&D&I TOTAL	**120.27**	**117.09**	**120.67**	**95.10**	**98.86**

Figure 4. Evolution of R&D contracts by the UPM

[1] The reduction seen in the period 2007-2009 is due to the disappearance of the CENIT program which involves a very considerable effort from the Spanish administration to promote R&D cooperation between business and the public system of which the UPM has taken significant advantage

Obviously, the financial crisis (and the consequent reduction in resources coming from competitive public calls at a national level) has, over the past two years, has affected the direct contracting with businesses (mainly OTT[2] contracts) although there continues to be an overall figure of contracting of 25% of the annual budget of the UPM.

1.2. Evolution of the exploitation of R&D results

In spite of this significant effort and the positive results achieved in the contracting of R&D projects, the activity in the **exploitation of R&D results** generated continues to be a pending subject for the Spanish university in general and, in fact, the situation at the UPM is also improvable.

In this case, the problem affects the UPM qualitatively to a larger extent than other universities since it is technological university in which a large part of the R&D activity carried out has an applied component susceptible to being used in the development of innovative new products and processes if this objective is posed in a systemic and institutionalised way.

What is certain is that the possible exploitation of the results[3] obtained from the carrying out of R&D activities in cooperation with the business sector is generally left in their hands. Even so, there is an evident margin for improvement since this problem does not appear in the case of European R&D projects nor in the projects for the calls for basic research in the National Plan for R&D&I in which, however, the is still a low percentage of the exploitation of results achieved.

Specifically, Figure 5 analyses the evolution of the patents applied for and awarded to the UPM by the OEMP. It is evident that in recent years a change has come about in the very positive trend (partially motivated by a greater recognition of this activity in the process for the promotion of the teaching staff).

[2] The OTT (*Oficina de Transferencia de Tecnología* (Office for the Transfer of Technology)) is the administrative unit responsible for the economic management of the projects which are carried out directly by the UPM as set out in article 83 of the LOU or in public calls. It must be borne in mind that the UPM also has contracts with the business sector by means of the foundations linked to it and especially the *Fundation General* (General foundation) of the UPM.

[3] Generally, the R&D contracts signed with businesses through article 83 of the LOU and the greatest part of the partnership programs of the PN of R&D&I cede these to industrial property and for this reason the exploitation of the results obtained (even in many cases, safeguarding the authors'' rights, the register of patents). Very recently, a scheme for the co-ownership of patents with businesses with which it has contracts has started to be applied by the UPM with uneven success.

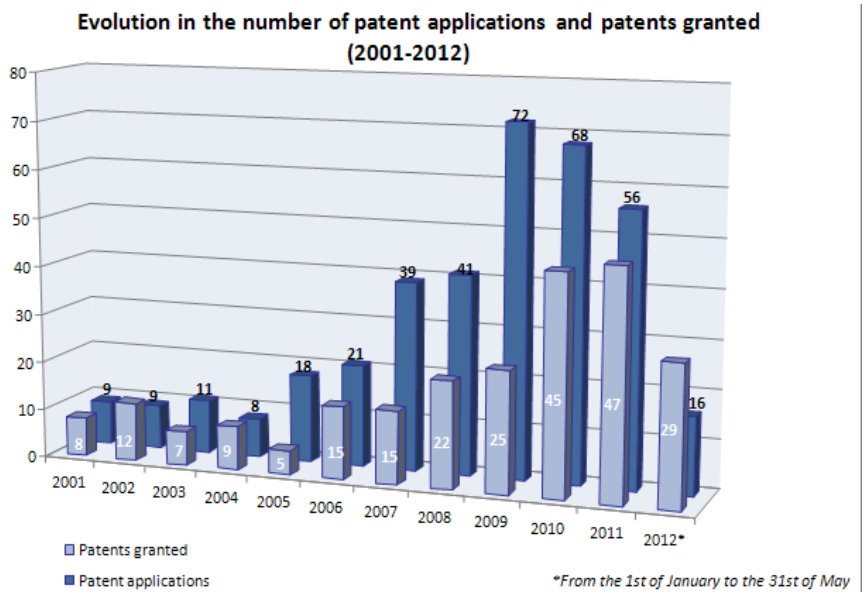


Figure 5. Evolution of the patents applied for and awarded.

As regards the internationalization of the patents it is enough to show that from the 1st January 2011 to the 31st May 2012, 88 international extensions took place, including PCT applications and the national phases of patents in third countries. These figures demonstrate the University's even greater commitment to the internationalization of its patents[4].

As regards the protection of intellectual property, it has concentrated mainly on the register of computer programs[5] and the publication of books and manuals by the teaching staff.

This positive evolution, however, is not complemented by the situation of two other main indicators: the **percentage of patents licensed** (and therefore, a commercial exploitation)[6], and the **financial resources generated by royalties** coming from them. In the specific case of the UPM, the first of the indicators shows that only 13% of the patents are under exploitation, and the second reflects a figure obtained by royalties of less than €400.000 annually (including, in this case, the exploitation of software programs).

On the other hand, many of the results generated and the knowledge generated around them ("know-how"), not necessarily protected in the form of patents or software registers, would be

[4] The restriction in this case comes from the UPM itself as the costs deriving from internationalization have increased substantially together with the maintenance of the patent portfolio. The internationalization of patents is only carried out then there are sufficient guarantees that it will give rise to an effective exploitation of them in other countries.

[5] As an index of the activity carried out, since the 1st January 2011 to the 31st May 2012, 34 software packets have been presented to the *Registro de la Propiedad Intelectual de la Comunidad de Madrid* (Register of Intellectual Property of the Madrid Regional Government).

[6] Throughout 2011 and the first half of 2012, a total of 10 licence contracts have been signed for the exploitation of patents with external businesses

susceptible to "exploitation" if there were mechanisms available that would permit their early identification and later maturity in direct connection with the business sector.

From the data presented, it is obvious that it was necessary, on the part of the UPM, to put instruments into effect that support the **improvement in the exploitation of R&D results,** be they by means of highlighting the technologies or knowledge generated, such as with the licences obtained through the patents or the registering of already protected software packets. In the last five years the UPM has set up several **pilot experiences** oriented towards this end; after that, the support instruments for the commercialisation of the technologies put into effect are analysed.

Still, it is necessary to systemise this process, extend its repercussion on the whole of the UPM and achieve an institutionalization of the internal units that are responsible for it. This document indicates the way followed and the actions undertaken to achieve these ends.

1.3. Support instruments for the commercialization of technologies

The support for the **commercialization of technologies** has as its objects the active improvement in the exploitation of the R&D results generated by the UPM.

This objective is being disseminated under the concept of ***"Innovatech-UPM®"*** (a recently registered brand) to highlight those technologies coming from the University ("***Technological solution promoted by the Technical University of Madrid"***). *To this end, a commitment has been made to the* **"model the commercialization of UPM technologies"** based on the collaboration of different agents in accordance with the following process.

- Internal **motivation**: through the dissemination of transfer concepts and the protection of results as a basis for the action strategies in projects for the commercialization of technologies between the PDI (Teaching and Research Staff) of the UPM. Unfortunately, there is no generalised awareness among the PDI of the importance of evaluating the possible exploitation of results from the beginning and during the implementation of an R&D project.
- **Generation** of technologies: coming from the R&D structures of the University (research groups, R&D&I centres, research institutes) in which it is necessary to actively implicate those responsible for the aforementioned units.
- **Identification** of those technologies susceptible to commercialization: interlocution with the R&D structures for the identification of projects with the potential for commercialization and the analysis of their level of maturity.

- **Development** of a plan for the commercialization and search for clients with the monitoring of consultants (internal and external) of the University that collaborate with it in this process. We have to bear in mind that this process must not be limited to just national territory. It will be necessary to establish contacts at an international level that will allow its commercialization in a wider context.
- **Contact** with clients: support in negotiation by means of licensing contracts, the drawing up and revision of clauses.
- **Closing** of agreements for the sale of technology with the implication of the specialized units of the UPM.

During 2011 a strategy for the more aggressive commercialization has been implemented on the basis of the aforementioned mo of the (still in the pilot phase) whose main elements are set out in Figure 6.

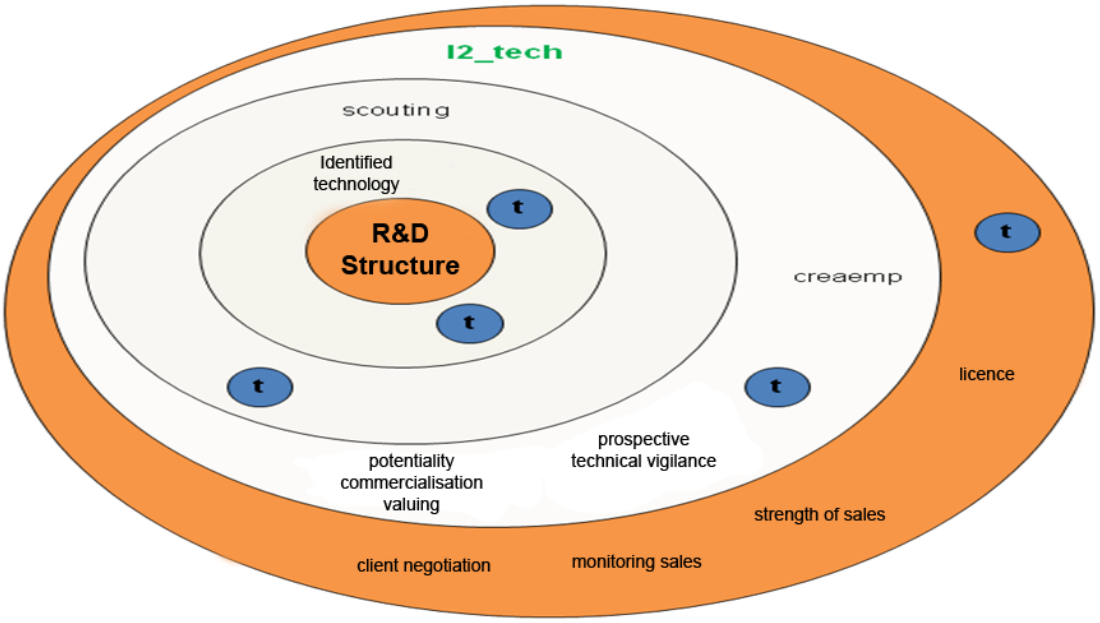


Figure 6. Commercialization strategy (pilot model)

Figure 6 represents several "circles" that the technologies can cover on their way towards commercialization (the "t" bubbles can be found in stages within the circles represented as can be seen in the Figure). The process begins with the identification of promising technologies in close contact with groups, R&D&I centres and university institutes. Some of the technologies selected may go on to a mechanism for the specific exploration of possibilities *("scouting")* which may be accompanied, at a later stage, by complementary prospective studies,

technological vigilance and analysis of the possibilities for the creation of a new business that exploits the technology generated. Finally, the signing of the licensing agreement is reached after the negotiation with the clients and the later mechanisms for the monitoring of the sales made.

It is evident that a process like that presented which involves substantial costs cannot be applied to all of the potential technologies. There must be a (risky) pre-selection process that limits those promising technologies to those with the human and material resources available to be able to deal with them. Associated to this process, a potential valuation of some UPM[7] patents in the market has commenced. The overall estimation will permit the portfolio of patents and software registers of the UPM to be valued as assets.

This pilot program has meant that during 2012 more than 50 meetings have been held with researchers responsible for technological solutions, in the majority already protected, for their analysis and evaluation on their commercialization.

As a concept trial in the support for the commercialization of technologies, the drawing up of **commercial files** has started, protected reports on the **commercial prospective** and **reports on possible licensees on technological solutions** on a reduced number of technologies.

On the other hand, the establishment of a **chair relative to intellectual and industrial property** with the company Clarke, Modet &Co will bring about an improvement in this aspect of the interested PDI and carry out studies on technological vigilance in the areas of interest to internal positioning. Likewise, 5 bulletins on technological vigilance on different subjects and the valuation of patents[8] have been drawn up within the framework of this chair. In this line of work bulletins on technological vigilance have started to be drawn up at the request of several businesses[9].

[7] As part of the commercialisation project regarding the Clarke, Modet &Co chair, it has collaborated in the valuation of 10 patents of the UPM.

[8] Likewise, the call for public financing has been managed for the valuing of "Innocash" technologies, carrying out dissemination activities with officially approved businesses and the administrative management. 2 technological dossiers have also been drawn up regarding the valuing of positively evaluated patents within this framework.

[9] As an example of this type of activity the drawing up of a technological report has been coordinated ("HTML5 and the compatibility in user agents") at the request of the company Global Line S.L. in collaboration with researchers from the *ETSI Telecomunication* (Higher Technical School of Telecommunications Engineering). The report was disseminated at the Mobile World Congress MWC – Barcelona 2012 (27 February – 1 March).

Figure 7 allows us to see an example of one of the commercial files drawn up for a UPM technology (**Glottex Voice Analysis System®**) within the ambit of biometrics that has its origin in a spin-off associate with the *Centro de Technology Biomédica* (Centre for Biometric Technology) in the Montegancedo Campus of Excellence. In the case set out, the technology is in a state of sufficient maturity (even with institutional clients) to go on to an intense phase of commercialization.

The UPM is aware that the implementation of these activities requires the availability of highly specialised staff which is not usually found in the PAS (Administrative and Support Staff) of the universities nor in the great majority of the OTRIs of Spanish universities. For this reason, the need to reach agreements with external entities (or with independent professionals) has been posed although this focus implies the need to share the potential benefits obtained for the commercialization.

This, still incipient, activity oriented to the commercialization has demonstrated the enormous possibilities and the interest aroused between the teachers and researchers at the UPM. It is necessary, however, to promote this process even more and give it a **professionalised management structure** which does not yet form part of the UPM.

A pilot initiative based on the use of **external entities for the international commercialization** of the knowledge generated in a specific line of research is the agreement signed with the *Fundation Marcelino Botín* (Marcelino Botín Foundation) in relation to the line of *Tissue Engineering* of one of the research groups from the Centre for Biometric Technology. It is still too soon to know the possible results.

The experiences carried out at other universities (as is the case of ISIS at the University of Oxford) demonstrate, on the one hand, the validity of this focus and, on the other hand, the difficulties inherent in its insertion into the university management scheme. The **Centre for Support for Technological Innovation (CAIT)** which will be presented later in this document reflects the institutional commitment assumed by the UPM in relation to the commercialization and exploitation of the R&D results.

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Glottex®: your voice cures you, your voice identifies you

Advanced biometric applications for the early clinical detection of voice pathologies and security

Glottex Voice Analysis System® is an advanced voice analysis product for the biometric analysis, the result of more than 15 years of research of a team from the faculty of Computer Sciences – The Technical University of Madrid (UPM). In its health version, it is currently applied for the early detection of voice pathologies and cancer of the larynx, as well as medical treatment and rehabilitation, at different hospitals in Madrid. Another line of development and with a great impact is based on the identification of the initial symptoms of neurological illnesses such as Alzheimer's or Parkinson's disease, using this application and associated methodology, equally, as a security application. Glottex is used by one of the Spanish security bodies for forensic identification through the voice.

Technological solution promoted by the Technical University of Madrid

Technological solution

Glottex Voice Analysis System®, known as Glottex, is a software application for the advanced analysis of the voice and the determination of the sample closest to the biometric vocal footprint. This new solution identifies with unique voice characteristics much greater feasibility by distinguishing those that derive from the vocal tract (pharynx, oral cavity, nasal cavity) typical of the source of excitation; the origin of the voice. Glottex is capable of evaluating and extracting physiological parameters unique to the glottal source, section of the larynx that is limited by the vocal chords and whose vibration is the origin of the voice. This is a decisive technological advance as regards previous solutions at the time of the early determination of voice pathologies, their treatment and the biometric identification of the speaker.

Sectors of commercial application

- **Health**: support for the early detection of voice pathologies, including symptoms of cancer of the larynx of neurological alterations.
- **Security**: forensic research, biometric systems for user identification and verification.

"Glottex is capable of determining the closest to the vocal footprint based on the intrinsic glottal wave of each individual"

Market needs

- **Health**
  - Voice disorders usually affect 5% of the world population with a greatest incidence being with young people and professionals who depend on the use of their voice. Early detection being a key factor for its treatment.
  - In 2008 cancer of the larynx affected 150.000 people. The incidence is rising and has a very great degree of mortality (Spain is ahead at a European level). Voice dysphonia is one of the main symptoms of this kind of cancer.
  - According to studies from the World Health Organisation, an estimated population of 6.8 million people die annually in the world as a result of neurological disorders.
- **Security**
  - There is an increasing global interest in viable biometric solutions and difficult settings (new and sophisticated security menaces).
  - The safe management of digital identity is key in many niche markets, with growing volumes of turnover (for example, mobile banking).
  - The departments of security and intelligence are recording with more frequency phrases related to crime. Greater complexity at the time of identify suspects by means of traditional methods.

"There is a growing demand for biometric technologies that ensure the viability and low cost of their implementation. Voice identification, especially remotely, is becoming of increasing attention"

Market potential

- **Health**
  - Demand for new innovative and low-cost diagnostic procedures of illnesses.
  - The European medical technological industry had sales of 72.6 Billion Euros in 2007, with an annual growth of 15% [Eucomed].
- **Security**
  - The turnover associated with vocal biometry doubled within the period 2011-2014. The market volume for this year is envisaged at 260 Million Euros with a rate of growth of 16% [Opus Research].
  - Innovative technological advances have relaunched the evolution of the forensic research sector through a much greater cost ratios.
  - The market for forensic products and services is estimated at 10.3 thousand million Euros in the USA [BCC Research].

Competitive Advantages of the Solution

- Support for the viable and early detection of symptoms of voice disorders by means of pioneering voice analysis through its technological and scientific basis.
- Line of research which allows the identification of the initial symptoms of neurological illnesses at an early stage.
- Low implementation costs in health systems: adaptable software tools, without specific hardware requirements. 50% savings in costs per patient according to estimates from the medical professionals who are going to use Glottex.
- Non-invasive and fast diagnostic technique without collateral effects for the patient. 50% savings in time per patient according to estimates from the medical professionals who are going to use Glottex.
- Maximum reliability in the biometric identification of the individual.
- Simple adaptation and low cost of the biometric tool to the infrastructure of the already existing voice.
- Biometric technology that allows remote authentification.
- Favourable market research as regards user acceptance of this biometric technology.

References

- Hospital Universitario Gregorio Marañón de Madrid.
- Guardia Civil – Spain.

Protection

- M-006038/2008 software register, presented at the Intellectual Property Register of the UPM.

Degree of development

- ◯ Concept
- ◯ Research
- ◯ Prototype-Lab
- ◯ Industrial Prototype
- ⊕ Production

Contact Glottex (BiometroSoft company)

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Figure 7. Support material for the commercialization of technologies

Finally, a pilot experience has been initiated with the imparting of the **1st Course in the Commercialization of UPM Technologies** (48 hours) specifically aimed at researchers. The aim

of the program is to show the tools and skills necessary to initiate a practical process for the commercialization of technological solutions. The course has been implemented by 27 researchers of the R&D&I structures of the UPM, each of them contributing a developed technological solution whose aim is to get to know its potential for commercialization.

1.4. Support instruments for the creation of new technologically-based businesses

The activity as regards support to the setting up of spin-offs (businesses that have scientific-technological knowledge from the University as their basis) and start-ups (other new technological businesses from a university environment with no direct implication of the teachers in them) are still in their growth and consolidation phase, as they have again experienced a relevant figure of participation of the university community. These figures increase the degree reached in previous years, by overcoming the difficulties, in which record participation was reached.

Figure 8 schematically represents the phases followed by the UPM in its program for the creation of businesses **(Action UPM).** The program starts from the basis of a "competition for the creation of businesses" from which, bearing in mind the most relevant ideas presented, the personalized training and evaluation phase in business management is developed, at the same time as working on other complementary activities that contribute to the drawing up of a business plan which analyses the feasibility of the projects presented[10].

[10] The initiative has institutional sponsors from the *Fundation Española para la Ciencia and la Tecnología* (FECYT) (The Spanish Foundation for Science and Technology) belonging to the *Ministerio de Economía and Competitividad* (The Ministry of the Economy and Competition) and the *Ministerio de Education, Cultura and Deporte* (The Ministry of Education, Culture and Sport) within the framework of the *Programa de Atention Integral and Empleabilidad de los Estudiantes Universitarios* (Program for the Integral Attention and Employability of Spanish Students). Additionally they are sponsors of the UPM Program for the creation of businesses, the businesses Accenture, FDI Internet & Mobile, InvestBan, Rousaud Costas Durán SLP, Savior Venture Capital and the company FLUOR, as well as the collaboration of the *Escuela de Negocios IEN Politécnica* (IEN Technical Business School), Axón Capital S.G.E.C.R., The magazine *Emprendedores and Global Incubator* (Entrepreneurs and Global Incubator) a start-up of the UPM.

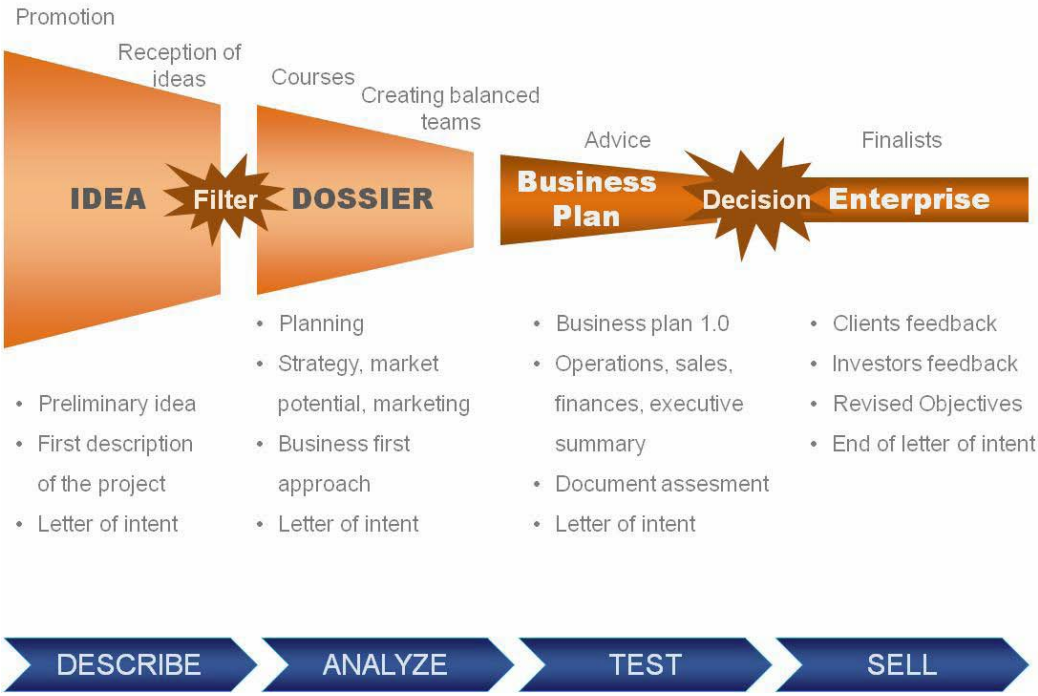

Figure 8. Phases in the process of the creation of businesses

The Competition in its ninth edition in 2012 has again increased the index of participation in relation to previous editions (see Figure 9). In this edition **474 business ideas** have been registered for all of the collectives and all of the schools in the University, maintaining the timid participation of the research centres proper to the UPM with their own business ideas. Many of these "ideas" as suggested in Figure 8 do not get to be crystallised in the setting up of a specific business but, still in this case, it means a personal experience that we believe valid throughout all of its professional development.

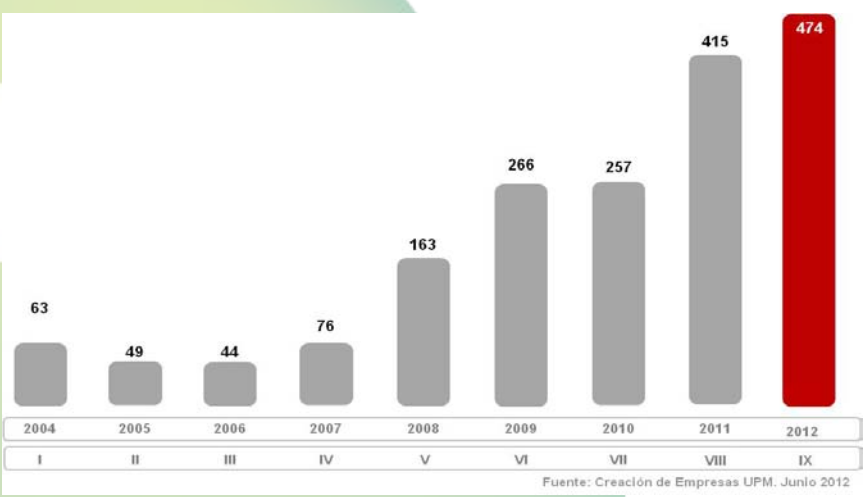

Figure 9. Evolution of the number of ideas presented in the Competition for the Creation of Businesses

In the 8th edition of the Competition (2011), 51 teams drew up a business plan after the training stage which involves a monitoring of an increasing number of business projects. More than 300 projects received personalized training and evaluation during 2011 and the first months of 2012 accompanied by an effort in dissemination and cultural change[11].

Finally it must be highlighted that during 2011, **17 businesses** (6 spin-offs, 11 start-ups) were constituted, whilst in the first half of 2012, this figure rose to 6 (3 spin-offs, 3 start-ups). Figure 10 allows us to see the evolution in recent years. In overall terms, the sum total of business created with the support of the Program for the Creation of Businesses is 116 with a survival rate of 84% after three years since their creation. Since 2007 these businesses have obtained investment funds to a value of more than 24.6 million Euros. Throughout 2011 and the first half of 2012, a total of 7 licence contracts were signed for the exploitation of technologies with spin-offs from the UPM.

The entirety of these numbers highlights a change in mentality. The creation of businesses is no longer seen as a fact far removed from university life, but is gradually becoming part of the activity of a public university.

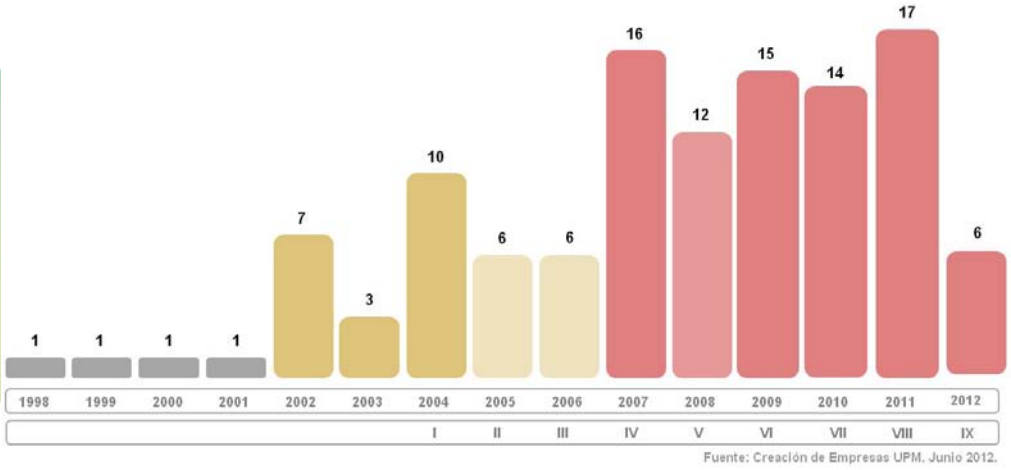

Figure 10. Evolution of the number of businesses created in the Competition for the Creation of Businesses

It must be highlighted that the UPM has two functioning **business incubators** (in the Montegancedo and Campus Sur campuses) (Figure 11 shows a photograph of the

[11] The number of workshops carried out in different formats increased throughout 2011 and the first half of 2012 to more than 70 making up a total of almost 4,000 attendees, and accumulating close to 10,000 in the last five years. Equally, during the same period 260 media impacts have been achieved in the communications media both internal to the University and external to it. They have been relative to businesses of the UPM and to the program itself.

Montegancedo Business Centre set up in 2009). Nevertheless, the strategic objective of the UPM is not merely the creation and later management of business incubators, nor the location in them of new businesses generated by the university, but the creation and strengthening of businesses with a technological base generated from the R&D&I activity of the UPM independently of the place in which they are located. The experience means that it is not necessary to force the location of the spin-offs created in specific UPM premises but in encouraging them to develop and promote them to locate in the places more suitably adapted to their activity and network of contacts.

Figure 11. Montegancedo Business Centre

The institutional policy followed by the UPM in its relationship with new technology-based businesses created by the university is that of **not becoming part of the body of shareholders**. The wish is that through this policy, these businesses are supported from the outside within a strict structure of private capital. It is also wished to avoid conflicts of interest with the board of directors and their promoters and the weaving of a complex bureaucratic network of control. The limitative consequence deriving from this attitude is to limit the shareholding of the PDI of the UPM to 10% which, in turn, can theoretically limit its interests. The accumulated experience highlights, however, that in practice it is not a dissuasive element[12].

1.5. Overall valuation of the situation: the role of the Montegancedo Campus of International Excellence

As a conclusion and overall evaluation of the effort made as regards the protection and exploitation of the scientific and technological knowledge generated, it may be said that the

[12] This does not prevent the UPM from **creating or participating in business entities with the implication of other entities** by means of the *Fundation General* of the UPM if the objectives are in agreement with those of the exploitation of knowledge generated by the UPM. In these moments, the UPM forms part of CENTESIL (together with Isofotón, Técnicas Reunidas, DC Wafers and the Universidad Complutense de Madrid), AIDIT (in this case with the UPC in the process of the incorporation of new shareholders and its subsequent reduction in the participation of the university) or in two AEIE (*Agrupation Empresarial de Interés Económico* (Business Grouping in Economic Interests) CRIDA in the case of Air Traffic (with AENA) and in Automobiles (con IMADE).

UPM is at the vanguard of national universities and with figures very similar to those found in other European universities (except those in an Anglo-Saxon environment)[13]. This positive evolution is being brought about, at the same time, in many other Spanish universities.

Consequently, it will become more common to find a positive evaluation for the combination of a fundamental research effort in university research groups and in the internal support policies (historically tied to the role of all of the universities) and collaborative research (emphasis on technological universities) together with a growing preoccupation for the use and exploitation of the results obtained.

In fact, it is already common to find in the institutional discourse of Spanish technological universities as regards the internal actions tied to **improving their benefits from the perspective of support for technological innovation** by attending to the different kinds of action (see Figure 12) and favouring the R&D effort having an impact on society.

This evolution is less evident when the composition of the annual budget is analysed, already weighed down by a predominantly teaching vision in the assignment of human and material resources and in the way in which the contributions of the AAPP are defined, nor in university structures (generally, these actions are classified in the Offices for the Transfer of the Results of Research, OTRI) that, in many cases, are far from the internal structures of the universities (involving, for example, foundations) and the lack of staff with experience in these fields without having put into effect agreements with external entities either.

[13] The UPM coordinates a project financed by the Seventh Framework Program for R&D of the EU (together with the universities of Oxford, The Technical University of Turin, The Technical University of Munich and Paris Tech) known as ULAB (University Lab) to analyse the trends in the evaluation of results, business creation, R&D structures and the dissemination in European Technical Universities.

Figure 12. Areas of support for innovation in universities

In spite of the growing political recognition by the AAPP and the universities themselves as has been indicated, the results obtained to promote a structural reform are scarce and it is not common for these internal structures in the universities to enjoy the financial and stability resources necessary to promote a change of mentality throughout the University.

Even though the creation of businesses or the commercialization of the results of R&D have been taking on a much greater importance, other areas such as the marketing of the knowledge existing in the university, or the putting into effect of actions for the active anticipatory promotion of capacities, although common in the business sector, have not been institutionally assumed objectives in public universities although they are slowly beginning to appear in the university environment stimulated by programs for the commercialization of the results[14].

There is therefore a predominating sentiment shared by a large part of the university communities in Europe (and Spain is not an exception) that these actions to support innovation are secondary elements for the social function of the university. Therefore they must have little relative weight in university life. Consequently, when they are implemented they are usually far from the heart of institutional decision making as opposed to the consolidated activity and felt by the University itself that demanded externally for training and the generation of scientific knowledge.

The data from the UPM presented in the previous pages seem to reflect, however, a different situation. It has contributed to three factors: a sustained institutional vision of the role that corresponds to a technological university as regards the exploitation of results, the existence of an experience, albeit limited, in the commercialization of technologies, and the existence of a **Campus of International Excellence (CEI)** which allows the process for the support of innovation to be accelerated.

The **Montegancedo Campus[15],** has obtained the title of *"Campus of International Excellence"* (CEI) in the call from the Ministry of Education in 2010. Its strategic approach as a "**Campus oriented to technological innovation"** emphasises the use of information and communications

[14] The same reticence in the need to break the taboo of marketing technological capacities exists in the marketing of the teaching supply, however in recent years it has been broken and the group of public universities have put into effect specific campaigns oriented at the capture of students(the private ones already do it).

[15] The Campus is situated in a plot of land belonging to the UPM of 480,000 m^2, the largest part of which is in the Municipality of *Pozuelo de Alarcón*.

technologies (TIC) and is dedicated to the addition of private entities (although it also has joint R&D&I centres and research laboratories with other OPIs and universities). It is novel in the national order, although closely linked to the shared vision of the role that the UPM must play with these entities in order to make the **ecosystem of open innovation** model a reality.

The actions envisaged for the Montegancedo Campus of International Excellence have been conceived from the integrated point of view of a triangle of knowledge. To this end, postgraduate research innovation and training is conceived as a whole with an innovative perspective playing a cohesive role with other entities. It must be borne in mind that in this sense, after the **modification of the Statutes of the UPM** made in 2010, the R&D&I and centres and university research institutes may also be responsible for the giving of postgraduate programs without professional attributions (Masters' and PhD Degree programs) and, in accordance with the departments, schools and faculties involved carry out specific undergraduate and postgraduate teaching activities. This modification strengthens the integrated character of the UPM's structures preserving, however its essential role[16].

In Figure 13 you can see a diagram showing the units established at the Montegancedo Campus of International Excellence in 2012 and its relationship with the aforementioned different perspectives of the triangle of knowledge.

[16] An example of this is the recent approval by the UPM of new undergraduate degrees in Biotechnology and Biomedical Engineering whose implementation, associated mainly with the ETSI Agrónomos (The Higher Technical School Agricultural Engineering) and the ETSI Telecomunication (Higher Technical School of Telecommunications Engineering), will have the support of the existing specialised R&D&I infrastructures of the CBGP (*Biotecnología and Genómica de Plantas* (Biotechnology and Plant Genomics)) and CTB (*Tecnología Biomédica* (Biomedical Technology)) respectively, both of them located in the Montegancedo Campus.

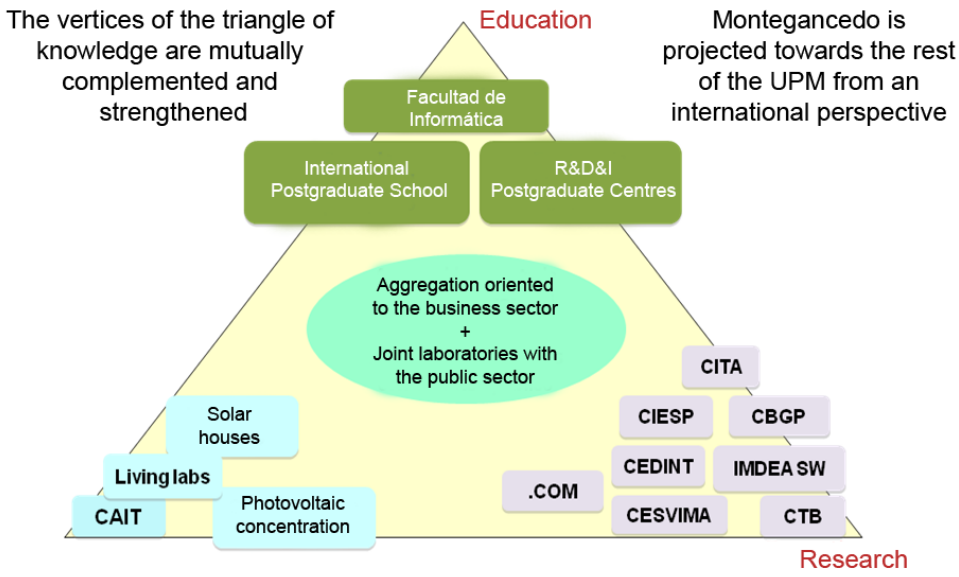

Figure 13. Units existing at the Montegancedo Campus of International Excellence.

The objective of the UPM**,** manifest in the creation of the **Centre for Support for Technological Innovation (CAIT) at the Montegancedo Campus of International Excellence** as will be presented below, responds to an institutionally supported vision of the role as a cornerstone of the innovative activity at the UPM which strengthens the remaining perspectives of the university activity without compromising their results. On the other hand, it allows them to increase both in volume and quality by shortening the period of time in order to achieve international relevance and opening doors to a greater number of agreements with third parties. This process is not simple, as will be explained below, and it will be necessary to break down a series of "barriers" common, to a large extent to all public universities.

2. Barriers in public universities in taking on an active role in the process of innovation and possible alternatives

Even though all universities carry out activities that can be considered as "support for technological innovation", their relative weight is very variable. Success will depend on the **characteristics proper to each university as well as the institutional strategy** that each of them pursues so that the support for (technological) innovation activity reaches a relevant role or not in the overall activity of the university.

In general terms, the universities must find a **proper model to support innovation** compatible with its teaching and research character and role, but which will allow it to **go from the use of passive way of thinking** (if it happens, it is simply accepted, and if not, it does not matter) **to**

another more proactive (the aim is for it to happen at the highest possible level assuming that this is an evaluable institutional objective) in which the whole of the University participates.

In a few words, if we wish to **improve the taking advantage of R&D results** in order to feed the innovation process, it is no longer enough to use a "*laissez faire*" approach to the private system (with a limited knowledge of the effort made by the university system) because the exploitation of the R&D results generated in the university context will continue to be very weak. It is necessary to accompany this process actively and in close cooperation with the business sector from the beginning of the research activity.

The current problem that is stopping the university from becoming a **key actor in the innovation process** can be summarised in the following factors whose solutions require specific actions and policies as described below:

- Although cooperation with the business sector is well regulated and supported by the AAPP and even favoured by the policies of the university institutions themselves in the R&D process, the situation **in the case of cooperation in technological innovation** is much more incipient and less intense although the applicable legal framework (article 83 of the LOU) is the same.

  Universities and businesses have historically considered that it is not expressly necessary to promote collaboration in "innovation", as opposed to what has happened in the case of R&D, as this activity corresponds to the natural role of the business who can carry it put without the help of the university ; to which it is superimposed, in the case of public universities, a certain valuation that an innovative activity is far from its main activity, and that teaching and scientific research, are the aspects that society must value. This context of detachment is strengthened as participation in innovation is not valued either in the individual promotion process of the teaching and research staff, and does not constitute a role socially acceptable to the university community as a whole. The reality is that neither the productive fabric nor the university take advantage of the potential benefits of being jointly involved in this area.

  Experience in technological universities has demonstrated, however, that the institutional valuation is very different when it is focused on **technological innovation** in close connection with applied research, and plays a pivotal role in the training processes and the exploitation of R&D results. This amplified vision of the role of innovation is relevant in

those universities of a technological nature as they directly affect the role that society itself wants the exercise and the culture of support is assumes institutionally.

A possible formula is the establishment of **joint actions with the business sector in especially dedicated centres** that allow long-term agreements to be established for collaboration in innovation. El use of science and technology parks promoted by the universities or the Campus of International Excellence recognised by the AAPP is considered as a conceptually suitable context for it.

- **The technologies, products, processes or technological services developed by the universities are in the main too immature** to be able to begin the commercialization process (directly or indirectly). The generalized erroneous perceptions that the degree of technological maturity achieved is sufficient is made difficult by the lack of university experience in knowing the difficulties in bringing a product to market together with the tendency of underestimating the difficulties in it (the engineering of products or processes reaches a fundamental value in this aspect) and whose responsibility would fall to "others". As a result, the failure rate in the “direct commercialization of research results" is high.

  In order to confront this problem, it is necessary to adopt **institutional support to the following phase of technological maturity** subsequent to the finalization of an R&D Project. This activity should be carried out in close collaboration with businesses with which the University has reached specific agreements or, in some cases, support with its own resources so that research groups are able to dedicate their efforts if it is linked to the creation of a new technologically-based business. It is simply not enough to assign financial resources, it is also necessary to have suitable means (even equipment and infrastructures) and technical staff with the suitable experience that research groups lack.

- The **transformation of experimental prototypes generated in the university laboratory** as a result of an R&D project **into other industrializable products** that can be evaluated by the industrial fabric for its future product or process engineering and subsequent commercialization demands the availability of **pilot plants** or access to them or **open laboratories** shared with the private sector with the teams that allow the generation of products with preindustrial qualities or the certification or calibration of the processes.

This need has never been present in the institutional agenda of Spanish universities nor have the suitable channels been developed to do so in cooperation with the private sector.

It is necessary to have **pilot plants** that allow the products and processes to be tested in controlled environments and enjoying the flexibility necessary to modify parts of it progressively in accordance with the results achieved, together with the evolution of the technology involved. A consequence derived from it is the need to increase the number of highly qualified technical staff by offering them professional studies according to their importance and not necessarily linked to research activities.

- **Knowledge on the needs of the user** is not effectively taken into account in the development process of a new product in the university context, thus delaying or reducing its potential impact. This situation causes many of the research groups in the public system to devise and develop technology assuming potential needs with no direct implication of the users who will facilitate a rapid feedback in the early stages of development and better adjustment in the design process. Even though it is clear that projects in consortia have been extended in the programs of the AAPP as a suitable formula to develop the open innovation models, the participation of the end users in them continues to be marginal. The use of interactive **technological demonstration** spaces may support this user implication.

  The creation of living labs in close cooperation with businesses and users in the sector seems to be a suitable focus for combining the development of technologies with experimentation on the part of the user. The experiences put into effect by the European Commission within the Seventh Framework Program (Cooperation Program) have turned out to be especially encouraging. The exchange of experiences and improved practices within the European network of "Living labs" has become useful for the development of a novel model.

  It must be borne in mind that the concept of "user" linked to a large extent to the activities that the UPM carries out has a very high technical level and its participation in the maturing process is not just restricted to ”experimenting” on a certain artefact when it has reached its almost final configuration but actively feeding back to the research group in the process of technological development.

- Conceptually, the inexistence or inadequacy of an already created business to develop and exploit the R&D results in close contact with the research activity could be avoided if a new technologically-based business with this objective were to arise from the research group itself. The possible creation of a technologically-based business usually goes through a stage prior to that which aims to mature the technology in the research group itself before formally constituting the business, at the same time as analysing the response from the potential market. This phase of the **"pre-incubation" technologically-based businesses** could be especially attractive for university research groups and institutional support programs should exist.

  We believe it necessary to **extend the concept of the business incubator** to include "quasi-businesses" which for period not exceeding one year can host promotion groups who are in the process of creating one of them. The experience of the business creation programs in some entrepreneurial universities in the USA together with some carried out by Spanish universities has proven to be a good basis for it.

- It is not usual to find teaching and research staff (PDI) who accept the possibility of continuing the development of some of the results generated in R&D activities in which they have been involved in a place or context different from that of the university itself (the case of administrative and support staff is even more complicated as a result of the legislative regulation governing them). Transferring to another business or simply carrying out the activity away from the University is perceived as a risk of distancing themselves from the source of the generation of knowledge (and postgraduate students) and, generally, stands in the way. On the other hand, the innovation process requires staff with profiles complimentary to those usually found in research groups to be incorporated and be able to set up multidisciplinary groups.

  The universities should facilitate and encourage this process of **mobility focalized on the innovation process** by developing the internal regulations and management procedures which allow the development of the results of the teaching and research staff to be explored. It must also be accepted that this activity is carried out part time with the immediate return to the previous fulltime situation when requested.

Likewise, it will be necessary to make it easy for the staff of the business to assume the responsibility for the maturity and exploitation of the technology, when installed in the university itself.

The usual combination in public universities of all of the weak elements as previously mentioned leads to a situation in which **the role of the university as regards technological innovation becomes blurred**. It is necessary, therefore, to make a **firm institutional decision** in the setting up of innovative initiatives at the service of the businesses that promote and increase the valuation of the R&D results.

3. Creation of the Centre for Support for Technological Innovation

3.1. Objectives

The **UPM** has taken advantage of the recognition by the Ministry of Education of its Montegancedo Campus as a Campus of International Excellence in 2010 to support the creation of the **Centre for Support for Technological Innovation (CAIT** – its initials in Spanish**)** with the fundamental objective of promoting the exploitation of the results of the R&D activity as well as serving as a stimulus to the innovation process in the business ecosystem close to the UPM.

It is not a question in this case of covering the needs of the campus specific to the UPM but to serve it as a whole. For this reason it is not expected that the **CAIT** will have a direct presence in all of the activities developed in the campus of the UPM but achieve a close symbiosis with the and especially with the Moncloa CIE (between the UPM and the UCM and coordinated by the latter university) also recognised by the Ministry of Education.

The justification for the creation of the **CAIT** arises from the analysis of the general situation and that of the UPM in particular as set out in the previous sections and the institutional will consolidate the already initiated process. Specifically, starting from recognising the success of the process of technological innovation and the transfer of knowledge from the universities to the productive sectors requires the design and use of **new institutional initiatives that strengthen the showcasing of the R&D effort** in a differentiated way from the strategies of an R&D&I centre or the activities within the scope of the research groups.

In the report requesting recognition of the Montegancedo CIE as a Campus of International Excellence (UPM, 2010), the creation of the **CAIT** was proposed, highlighting its main mission as "*complementing the activities of the current **Business Centre** and permitting its expansion by*

*configuring polyvalent and multifunctional **informal spaces** for the promotion of innovation dedicated to the finding and exchange of ideas (mini agora)[17], to the installation of Living Laboratories that develop the concepts of **user-driven open innovation**, the setting up of technological demonstrators, and the location of units in the UPM itself oriented to the commercialization of results. This function would be complemented by the location of spaces for already constituted businesses that develop concepts arising from experiences with the UPM although not strictly speaking considered as "spin-offs" or "start ups*"

This generic mission continues to be valid today. With it, it is expected that the **CAIT** will consolidate the already proposed objectives in the whole of the University by **strengthening the entrepreneurial and innovative spirit of the UPM**, the exploitation of the results of technological research and the valuing of the results of R&D in close connection with the private sector.

The development of the **CAIT** will be carried out progressively by talking advantage of the existence of the current Montegancedo Business next to it. There is however a significant conceptual difference between the Business Centre and the **CAIT**: although the former has been oriented towards the location of a business incubator (in a conventional mo of the linked to the science and technology park of the UPM), the latter will concentrate on activities for the commercialization of results supported by the existence of technological demonstrators or Living Laboratories. The creation of new technology-based businesses constitutes one of the possible focuses for the commercialization of results but not the only one.

3.2. Innovative ecosystem associated with the UPM

The transforming power of a university in the socioeconomic environment does not depend exclusively on the university itself, but on the wealth of the relationships with the environment that can be built around it. This objective, still far away from the usual activity of European universities is beginning to come under the microscope. In a recent report (CEPES and Ernst&Young, 2012) a change supported by the creation of **innovative ecosystems** is championed (this expression understood as "*platforms dedicated to facilitating the cooperation between different actors throughout the value chain, including intermediaries and accelerators of open innovation*").

[17] As an example, there is a restaurant in the CAIT to provide service to all of the Campus with innovative technologies resulting from the CENIT program in the "Hotel of the Future".

The term ***"ecosystem"*** has been applied to a multitude of different environments and with meanings that are not necessarily convergent[18]. In this particular case this term refers to the **"series of public and private entities that together with the UPM share the objective of technological innovation by stimulating the creation of business products, services and fabric from the knowledge generated or promoted jointly".**

It could be stated that this objective has been informally developed over a long period of time insofar as the cooperation of the UPM with the business sector has been consolidating itself and evolving since the creation of joint units; also insofar as a new innovative business fabric has been generated as demonstrated by the number of spin-offs created, and slowly, the increase in the commercialization of technologies and knowledge.

What has been around up until now is an **institutional structure to support the innovation** that cover some wider-ranging and ambitious objectives which exceed the scope of the UPM itself but this to be taken advantage of and accelerate its own development. It is a question, definitively, of putting into effect the creation of an ***"open technological ecosystem"*** promoted from a public technological university. Emphasis is made with this name to the "technological" character of the ecosystem, linked to the development of products or processes based on technologies, but this does not mean that the other element necessary to increase the confidence between the participating actors are discounted.

The **Montegancedo CIE** means a specific nucleus of action in which the aforementioned concept of an ecosystem can be developed quicker and with better perspectives of success: it comes together in the same central office of the Science and Technology Park itself (enjoying, among other elements, a business incubator) with research or technology centres, or joint laboratories, our own or created with other entities, and with a close relationship with schools and facilities, R&D research centres or institutes, located in other campuses of the UPM.

With the development of the open technological ecosystem of the UPM it is aimed to create a really positive process that cover the following specific objectives:

1. **To attract new innovative businesses** that are in a favourable environment to establish strategic alliances with the UPM and that combine its own activity with the

[18] Slinger Jansen (2009) has defined an ecosystem software as: A set of businesses functioning as a unit and interacting with a shared market for software and services, together with the relationships among them. These relationships are frequently underpinned by a common technological platform or market and operate through the exchange of information, resources and artefacts.

carrying out of joint R&D activities with the UPM and with other entities of the ecosystem[19]. Some of these entities may not come from the EU but from other places (for example the USA or the EU) in such a way that they favour their interaction with the UPM and the commercialization of its results.

2. **Accelerate the development of technology** through activities that facilitate the integration of technologies, their process of maturity into commercialized products and services, their active interaction with users throughout the life cycle of the products, and underpinned by commercial promotion in the international market.
3. **Develop the spin-offs** generated by the UPM or by other entities in partnership with the Montegancedo CIE **more quickly** (for example, from those entities with which research or mixed technology centres have been created) accelerating their process of growth and internationalization through agreements with investors and access to other technologies available in the ecosystem.
4. To bring a series of **service platforms** into service to the partner entities that make their location in the Campus attractive together with the collaboration between them for the integration of technologies and bringing to market.
5. Support the search for **external financial resources** for R&D activities, for the process of commercialization of technologies, and for the growth of spin-offs making the foreign investment in technology in Spain more attractive.
6. To know **market needs and trends** better with the aim of concentrating on acting in those areas of technology in which business investment is currently made and with it influence the activities of the UPM and those of the entities associated with it in the innovative technological ecosystem.

Figure 14 describes schematically the characteristics of the **open technological ecosystem** which has been made reference to. From this point of view, the **CAIT** must not be considered as an isolated incident but as an integral part of the **innovative ecosystem** associated with the UPM as the structural commitment that acts as a catalyst in its development (see this role in figure 14). The need to cover this catalyst and intermediary function in the innovation process has started to be identified as an essential element. Thus the need to have "specialised actors in the articulation and selection of new technological options is recognised in the search for

[19] It must be recognised that this objective is not very far from what it is considered that a Science and technology Park should do. The main difference is, in this case, is that as it is a Park-CEI promoted by a public university it assumes a very proactive role in the development of an innovative ecosystem.

and location of sources of knowledge, in the building of connections between external providers of knowledge and in the implementation of business and innovation strategies"[20].

Figure 14 situates the **CAIT** at the crossroads between the providers of technology (proper to the UPM or external to it but in relation to it) and access to the external market. It is not a question, therefore, in the **CAIT** of developing technology but of facilitating that which matures quickly.

Figure 14 also suggests that the CAIT only makes sense in that the other components indicated suitably cover its function. Its mission in an ecosystem (not solely in the UPM) means that the creation of spin-offs is emphasised not necessarily from the UPM, the commercialization but by creating businesses specific for it or through already existing businesses, or integrating technology from other actors. It is evident, however, that a founding objective of the **CAIT** is to strengthen those aspects in the UPM but we are aware that its role goes beyond it.

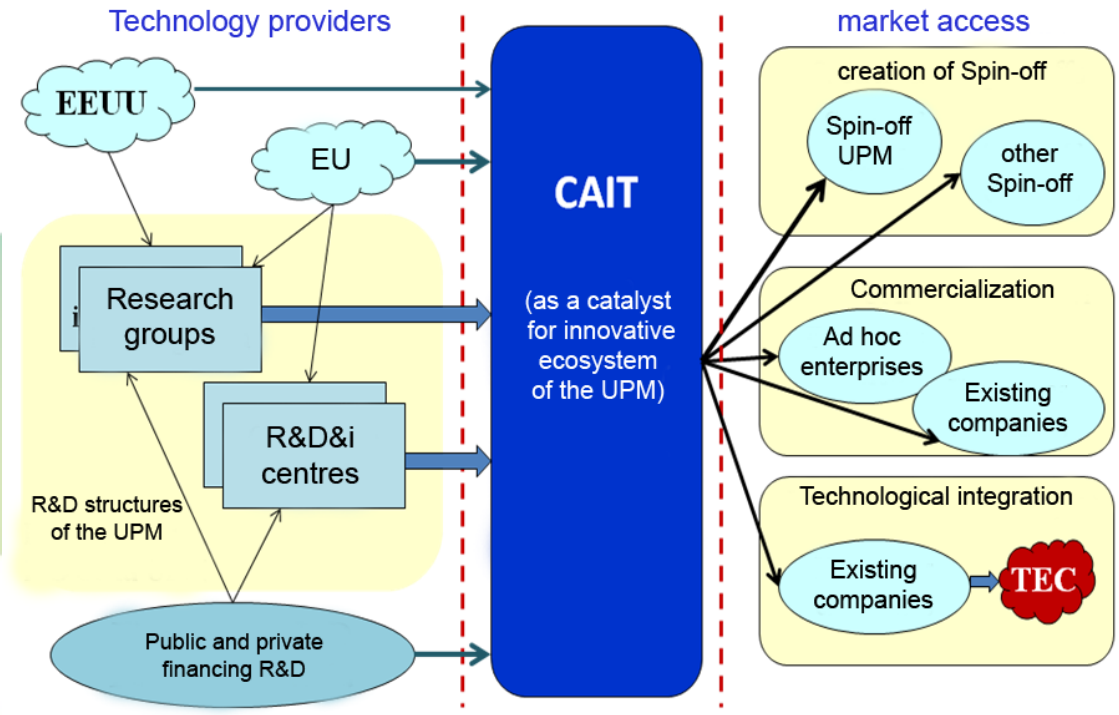

Figure 14. Elements of the innovative ecosystem of the UPM

[20] Some of these structural schemes for open innovation have been devised to serve as structural modernization in global businesses that must access a knowledge that is not possible to find internally. The object that we are pursuing in the CAIT is to transfer this focus to the concept to an "ecosystem promoted from a public university" ("*university -driven open ecosystem")* for which it is necessary to take into account the peculiarities proper to this public context.

For the proposed innovative technological ecosystem to work as such, it will be necessary to create a **link of belonging** with it to all of the participating entities. This link is simpler to create when there is a physical location for which the entities located in a certain campus (as is the case of the Montegancedo CIE) share spaces, platforms and services and, especially, information. The UPM must make, however, an additional effort to make this scheme a reality in the whole of the campus of the UPM and not just in the Montegancedo CIE[21].

The following section will describe the structure and organization proposed for the **CAIT** with the aim of attending to the highlighted objectives.

3.3. Structure and organization of the CAIT

3.3.1. General structure

The commitment of the UPM for the support of technological innovation will be specified in the **formal creation of the CAIT** to cover the objectives set out in the whole of the innovative technological ecosystem of the UPM. The following areas have been specified:

1. **Area of the commercialization of technology** with the following objectives:
    1. Support the commercialization of technologies generated at the UPM
        a. Identification of technologies susceptible to being commercialized
        b. Support for the drawing up and negotiation of licensing contracts
    2. Support the creation and internationalization of spin-offs
    3. Establish access agreements to technological financing with foreign investors (especially the USA and of the rest of the EU) to accelerate the process of expansion of UPM technologies.

2. **Area of product development** with the following objectives:
    1. Facilitate the industrialization of prototypes generated in R&D projects for those that require an additional financing with the object of reaching a state of maturity sufficient for its later commercialization.

[21] Although the CAIT will be located in the Montegancedo Campus, a similar process of support to innovation must be carried out in the **Campus Sur** and the **Tecno-Getafe** in which there is a similar opportunities for the development of an innovative technological ecosystem of the UPM; for this it will be analysed in the process of the putting into effect of the way of delegating subunits and carrying out activities in it through an analysis of opportunities. The **Moncloa CIE** constitutes a special case (associating it to the schools and faculties based in the centre of Madrid) given that as regards another CIE in cooperation with the Complutense University of Madrid (and coordinated by the former university) it presents characteristics of governance that must be agreed between both universities in order to look for the maximum synergy of activity.

2. Creation of a "pre-incubator for businesses" (business projects of a technological nature during its incubation phase)
3. Location of the specific ecosystem of the COM (Centre for Open Middleware) technological centre which will be described below.
4. Collaboration with the node associated with ICT-Labs (KIC of the European Institute of Technology)

3. <u>Area of technological demonstration</u> with the following objectives:

1. Development of "Living labs" in areas in which there is a series of businesses interested in its use or later development. At his moment the following have been considered[22]:
    i. Living lab "TV 3D"
    ii. Living Lab "Hotel of the future"
2. Development of demonstrators in which there are areas of interest to innovative businesses. At his moment the following have been considered:
    i. Photovoltaic concentration pilot plant
    ii. Modular homes with photovoltaic solar energy

4. <u>Area of strategic management</u> with the following objectives:

1. Management of strategic innovation projects
2. Management of the UPM Park
3. Management of the Montegancedo CIE
4. Secretary and Coordination of the Advisory Council
5. Organization of events and the giving of specialised courses and seminars related to innovation.
6. Location of university-business chairs of an institutional nature related to the **CAIT**. At this moment there are two:
    i. Clarke, Modet &Co (oriented to the protection of technology)
    ii. FDI (oriented to the creation of businesses)

Figure 15 presents a schematic vision of the basic elements of the CAIT in its four basic areas. Each of these areas is described in the following sections.

[22] These two living laboratories have financing specific for their implementation. In the case of 3D TV a temporary location has been found in the current business centre.

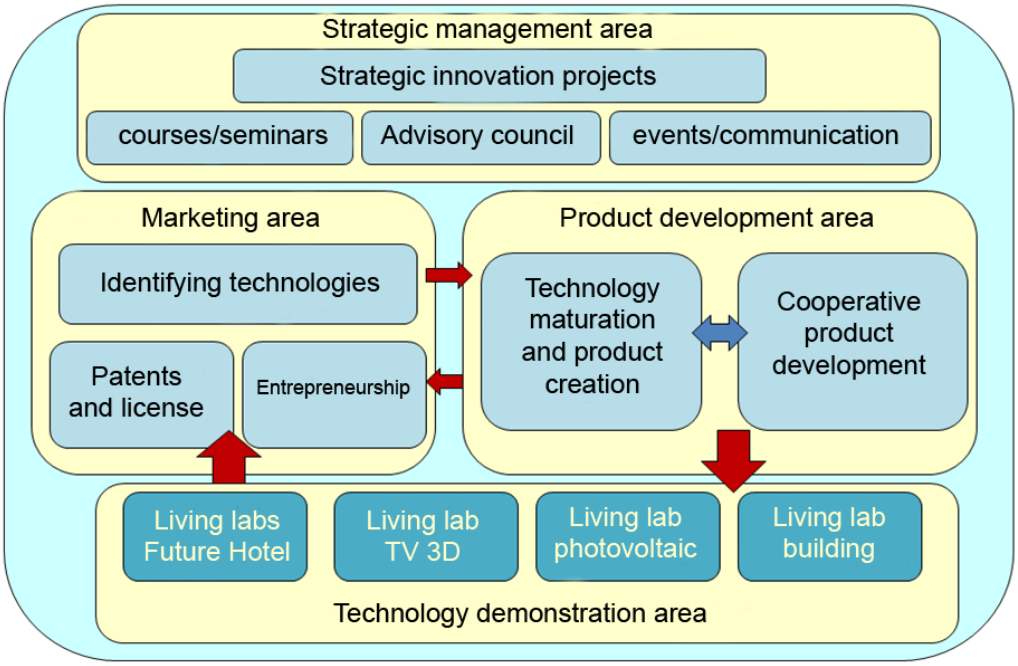

Figure 15. Proposed structure for the CAIT

These basic areas are complemented between themselves so as to cover the general mission of the **CAIT**, and will be developed after that. From the management of the **CAIT** the signing of institutional agreements with large businesses to the benefit of the entire UPM will also be promoted although it does not constitute an activity proper to the areas of the CAIT:

3.3.2. Area of the commercialization of technology

The area of the commercialization of the technology of the **CAIT** aims to provide continuity and strengthen the pilot activities initiated by the UPM in 2011 and 2012 as regards the commercialization of the technology generated that has been identified as an opportunities based on the R&D activities that are going to be carried out.

For this, it is aimed to **systematize the process of the identification of potentially commercialzable technologies** already initiated in pilot form within the OTRI of the UPM with an activity closer to the research groups and centres.

It is expected to begin the commercialization process with those technologies derived from the participation of the UPM in international projects in which there has been a relevant participation by taking advantage of the experience generated in the ULAB project[23]. Initially, three priority technological areas will be considered given the characteristics of the centres located in the Montegancedo CIE:

[23] This activity will be carried out in collaboration with the European Projects Office (OPE) of the UPM

1. **Information and communications technologies**
    a. Starting from the technologies existing in the cases of the research centres in the Montegancedo CIE related to the TIC such as CESVIMA (supercomputing centre), CEDINT (domotics centre), COM (open middleware centre) and IMDEA Software, together with the research groups of the Faculty of Computer Sciences; all of them provide a series of basic technologies of great interest for its later commercialization. Likewise, the CITA (Centre for Aerospace Technology), already linked to the space sector also carries out the majority of its activity in relation to the development of TIC applications.
    b. In the Montegancedo CIE Business Centre there are likewise located several business from the TIC sector to which aid may be expressly given.
    c. It is also possible to locate already constituted businesses of the sector that generate cross activities with units of the UPM. Of special interest is the location of "spin-offs" from other countries that are thinking of using the Montegancedo CIE as an expansion platform for its activities in Spain and the EU.
2. **Biomedical and biotechnological technologies (including bio-computing)**
    a. In this case the research centres located in the Montegancedo CIE: CBGP (Centre for Biotechnology and Plant Genomics) and CTB (Centre for Biomedical Technology) will form the nucleus for the identification of technologies susceptible to being commercialized by the UPM. In any event, the setting up of the scientific-technological **BioTech-UPM** (UPM, 2009) initiative has brought about an increase in the development of these technologies in the whole of the UPM which will be, likewise, attended.
    b. There are some spin-off businesses located in the Montegancedo Business Centre based on these technologies which will allow a cross fertilization with the activities of the research groups as is already happening (Plant Response Biotech, BioMetro Soft, Algenex[24])
    c. There is an opportunity to locate a spin-off business from the US pharmaceutical sector in Montegancedo (the development of new medicines) from the agreement signed with the University of Colorado (Anshutz Medical Campus in Denver).

[24] Plan Response and Biometry Soft are two spin-offs of the UPM (the first one arose from the CBGP and and the second from CTB). Algenex is a biotechnology company arising from INIA also related to the CBGP

3. **Energy technologies**
    a. CEDINT is found in this domain both in its domotic control version to improve energy efficiency and in its activities in the concentration lenses for solar energy.
    b. The installation of a photovoltaic concentration pilot plant will also offer a magnificent field of trials for the distributed generation and strengthening the activities in the intelligent network.
    c. The campus houses the company LPI (Light Prescriptions Innovators http://www.lpi-llc.com/index.php), an entity associated with CEDINT, is going to permit the development and commercialization of technologies linked to this environment.
4. **Architectural technologies and the preservation of heritage**
    a. In this scientific and technological domain, the CIESP (Centre for Research and Studies into Heritage) will make up a basic element of the activity in these types of technologies. Its importance will grow, in the next few months, given the strategic interest of the UPM in promoting a scientific-technological initiative on the "The City of the Future" which is in the process of definition (UPM, 2012b).
    b. The existence of the demonstrator of homes with photovoltaic solar energy and the existence of agreements with different universities with which the UPM is collaborating in the development of the *Solar Decathlon Europe* (SDE, 2012) offers very important possibilities for activity in the integration of architectonic technologies with those of energy efficiency.

The **state of maturity** of the aforementioned technologies will be identified in each of these environments (and the steps necessary to reach the degree of maturity necessary for their commercial exploitation), their **degree of protection** (and, in this case, the strategies for international extension), the **commercialization possibilities** (both in Spain and in the EU), and their **commercial files** will be drawn up as well the public presentation in different investment forums.

In those cases in which it is necessary or advisable to carry out studies into technological vigilance that allows the possibilities for action to be known in the areas associated with the identified technologies. Likewise, presentations will be made to possible interested parties. The **commercialization files** drawn up on some technologies in the commercialization pilot

plan put into effect in 2012 gives us an idea of the existing possibilities although it will be necessary to establish more suitable channels of dissemination.

Likewise, it is expected to support negotiation as regards the **contracts for licensing the technology** that requires specialised staff. At these times, the support given is very weak and not very specialised, leaving the responsibility practically in the hands of the research groups. In this environment, still accepting that each negotiation may require an analysis of the differentiated opportunities, it is possible to establish some general regulations of the UPM that are not available at the moment.

Finally, it is expected to establish agreements on **Access to financing from foreign investors** (especially the USA) that allow the internationalization of spin-offs. In this sense, the agreements with the University of Colorado in Denver (USA) that have the support of the Montegancedo CIE may be fundamental elements in reaching this objective. Definitively, we are convinced that the potential market of the technology of the UPM is global and we must direct ourselves towards it.

This area for the commercialization of technologies could also provide services to other businesses based in the Campus with which there are agreements in specific technological environments. Equally, it will be possible to be supported in already constituted businesses so that they can carry out this function to the benefit of the UPM by means of specific agreements[25].

Associated with the development of the **CAIT,** the creation of a business in Spain representing Fitzsimons (USA) is proposed with the objective of developing European Business plans and the search for financing. This business will have an agreement with the UPM (by means of the **CAIT** and of the CTB) to use the incubator infrastructures. By means of this business it is expected to provide the following services to start-ups which have an objective of internationalization:

1. Creation of business plans for European start-ups selected in Colorado (USA)
2. Identification of the work teams for their development in Europe
3. Search for financing
4. Identification of Spanish start ups candidates to extend its business plans in the USA
5. Management of services for the start-ups in the USA (CEO, Marketing/Sales/CIO)

[25] One of these agreements was signed in 2012 with Plant Response Biotech for the commercialization of the protected technologies generated in the area of the CBGP. This pilot experience will demonstrate the potential of this cooperation scheme.

From a vision of the process, figure 16 represents the phases that could lead to the commercialization of products. Although the **CAIT** must serve as a support platform towards commercialization, it will be necessary to have the competition for entities external independent professionals who know the processes and sectors well. These objectives are linked to the identified technologies.

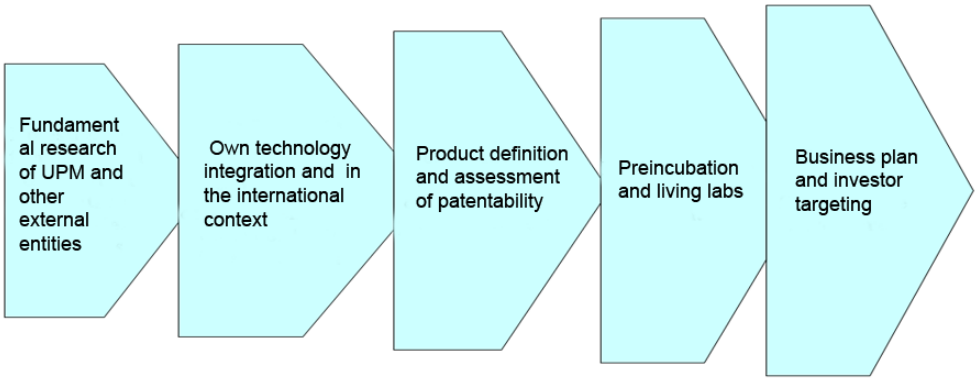

Figure 16. Commercialization process of in the **CAIT**

It is likewise proposed that the current **Area of Business Creation** existing in the UPM (currently attached to the OTRI of the Vice-Rectorate for Research) and responsible at the moment for the "ActúaUPM" program goes on to form part of the CAIT by transferring its staff and activities to it. The document does not describe the current activity in detail however it can be found on the Web page of the UPM (http://www.upm.es/institucional/Investigadores/Apoyo/OTRI/CreacionEmpresas)

3.3.3. Area of Product Development

The generic analysis carried out on the maturity of the technologies proceeding from university activity (see section 2) reflects in general terms a degree of maturity insufficient for its immediate commercialization. The need is evident to continue the development work towards the obtaining of industrializable products for a considerable time until the finishing of the R&D project that gave rise to it[26].

This task is commonly carried out by the spin-offs in the process of the creation of the business or in the first few months of its activity (having seed financing that is consumed once the

[26] The limit of the activity that it is possible to carry out from a university laboratory has been the object of debate for a long time. The problem is not centred solely, although also, in the existence of equipment suitable to bring to pre-series production, but in the sense that this activity has in a university context. In the case of the UPM there are accumulated experiences that it is necessary to foresee the subsequent phases before undertaking specific *"productization"* activities

business has been created)[27]. To strengthen this step in its initial phases it is aimed to install a **pre-incubator of technology-based businesses** in the **CAIT** in which the fundamental effort is oriented to making the products or services more robust so that its entry into the market is carried out under the best conditions for success coinciding with the creation of the business itself. This process requires a specific financing so that the **CAIT** will search for resources, be it directly or through contracts for differed sale or licences for the use of the products. The use of pre-competitive sales technology mechanisms could be especially interesting when the UPM itself (or other universities and OPIs in its environment) may benefit from it.

In other cases, it is not expected to create a new business but simply to facilitate the **industrialization of prototypes** generated in R&D projects by the research groups of the UPM for those that require an additional financing for the purpose of its transfer to another already constituted business. This initial activity may require substantial financing and period of time of more than one year.

This area will benefit from two elements developed incipiently in 2012 in one case or whose activity will commence in January 2013. They are going to mean a substantial improvement as regards the current situation: the location of the ecosystem of the COM technological centre, and la participation of the UPM in the node (initially associated) of the innovation and knowledge of the ICT-LABS community of the European Institute of Technology.

The "open middleware" ecosystem of the COM technological centre has been designed as a specific commitment linked to the development of the centre itself. It will mean putting an open encoding platform at the disposition of interested businesses for the development of software systems and applications. Initially linked to the finance sector with the support of SBAN and PRODUBAN (businesses from the Santander Group) its benefits could reach many other software development businesses in environments different from those in which it is necessary to use open code components integrated into open platforms at the disposition of the developers. The open platforms will be put at the disposition of the interested businesses from January 2013 with a specific support for it.

The objective pursued is that in 2013 between four and five businesses will be installed close to COM to take advantage of the services available for it. In a second phase, its internationalization is envisages taking advantage of the infrastructures available for the *Grupo*

[27] It has to be borne in mind that the great majority of the seed financing available demands that the new technology-based business has constituted that which increases its risks.

Santander in the USA, China and Brazil for some of the initiatives that may arise in Montegancedo.

On the other hand, the participation of the UPM in the node associated with the KIC of the ICT Labs[28] that will be located in the IMDEA Software at Montegancedo will constitute an excellent opportunity to accelerate the process of the definition of new businesses or business models around information technologies and that of communications in a European context.

Finally, there is the possibility of promoting the use of the facilities for the development of clinical trials of specific products of the pharmaceutical sector. Agreements are being developed in this environment with UCB for the development of drugs in the neurological environment (especially clinical trials) and it is expected that similar activities will be carried out with the University of Colorado with the active implication of the CTB in both cases.

3.3.4. Area of technological demonstration

The area adopted as the activity model is the concept of "open innovation oriented by the user". In order to make it a reality two especially relevant elements are considered which will be the object of attention during the putting into effect of the **CAIT**: the development of **living labs** in areas in which there is a series of businesses interested in its use and can start with technologies of the UPM that have reached a sufficient degree of development, and the existence of **pilot plants and technological demonstrators** which allow the users an early interaction which provides feedback on the process of product development. Both kinds of activity lead on to an additional step to the conventional activity in a university context.

Living laboratories in Montegancedo

As can be seen in figure 17, one of the objectives pursued in the use of "Living Laboratories" is that of attracting future investment that bring the exploitation of the technologies developed (or integrated closer to market by presenting commercialising of industrial businesses the possibilities offered by a certain solution (even, if it were necessary a small adaptation to certain markets) and guarantee the penetration of a certain product or service into a specific subsector of the market.

In order to achieve this objective, the professional profile of the university staff associated with the "Living Laboratories" will not be only that of the researchers who participate in the

[28] The UPM has been invited to participate as a university in the new nose associated with the KIC ICT Labs which will be coordinated by IMDEA software and in which it is envisaged that Telefónica, ATOS, BBVA, BSC (Barcelona Supercomputing Centre) and INDRA will participate. The node will be established in the Montegancedo CIE from January 2013.

development of the technologies but also *other profiles oriented to the introduction of products and experts into the market*. The kind of staff required for these structures is not usual in the administration and service staff (PAS) of the universities. This situation may require the university involved to have a specialised structure with sufficient stability

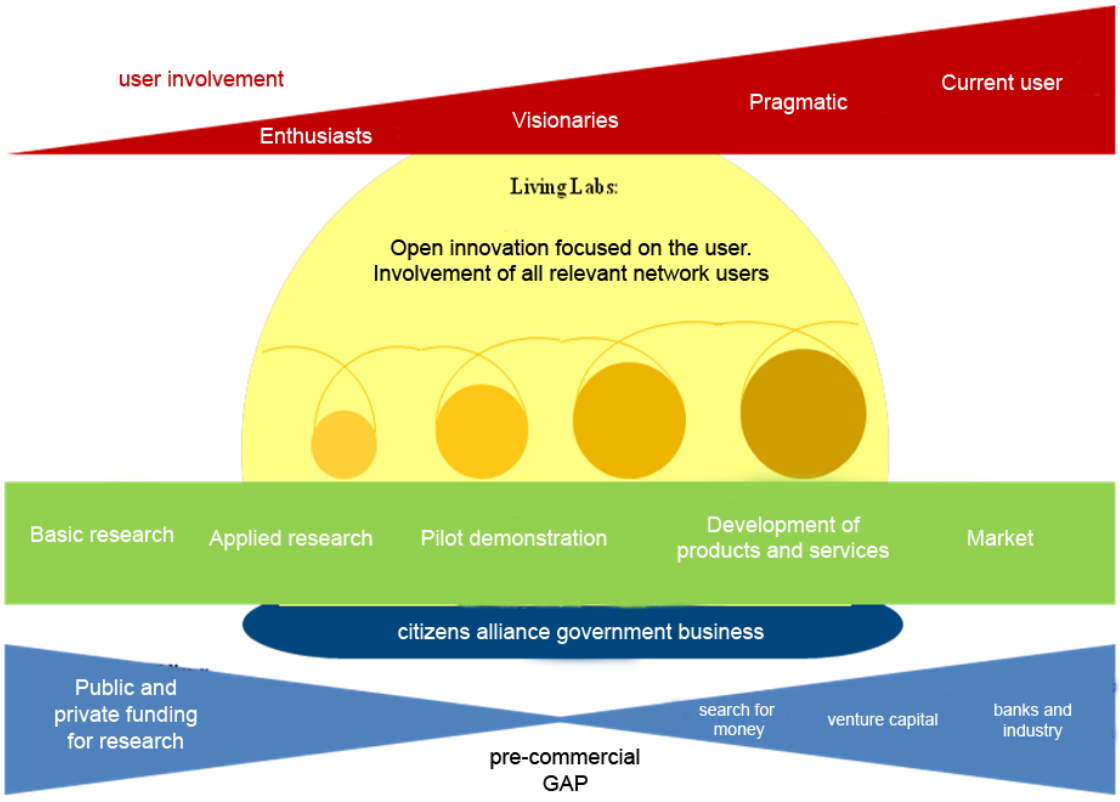

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Figure 17. Innovative process linked to the use of living labs (source: European Commission)

You can also see in figure 17 that the concept of "user" that we are making reference to is not necessarily the final user accessing a product or service through a retail distribution channel. The **user-type objective** of the **CAIT** is a more technical user able to establish a relationship with the developers and provide technical feedback on the development of a certain product. We think that by offering the Living Laboratories to the products developed by business spin-offs or business projects conceived by the CEI, it may help to accelerate its maturity.

In short, the UPM considers the **creation of "Living Laboratories"** of vital importance, as a visible part of its strategy of innovation, the fruit of partnerships with businesses from the productive sector and its later location in specific spaces in its campus in R&D&I centres or in specific centre of support to innovation). Specifically, the incorporation of "Living Laboratories", as a differentiating aspect of the Campus of International Excellence or the

headquarters of the UPM Park as opposed to that usual in other universities, constitutes, in turn, an instrument to **promote public-private collaboration** with the aim of developing new products or services from the technologies generated or participated in by the UPM itself[29].

The internationalization of some of these laboratories through their adhesion into the network of "Living Labs" (currently limited to the area of TIC in the 7th Framework Program), supporting the international exploitation of the knowledge generated, the reduction of technological risks and the negotiation of the exploitation of the results of the R&D of the UPM, or the possibility of financing the development of some technological components from them, are some of the indirect benefits that it is hoped to achieve.

In this context, the Montegancedo Campus will house the facilities of the **CAIT** or in other spaces and research centres at Montegancedo, different Living Laboratories centred on different areas:

Living Laboratory of the Hotel of the Future (installation envisaged in the **CAIT**). Oriented to the **hotel and catering sector** using CENIT THOFU (Technologies of the Hotel of the Future http://www.thofu.es/) as driving businesses that form part of the project. The fundamental objective of the project is to **advance the state of the art** of a series of emerging technologies in **building**, **sensors, information and communications**, and **interaction**, envisaged as being a great potential impact in the tourist sector, and in particular, in the advance of new accommodation concepts for the traveller. Its ultimate objective is to lay the technological foundations for the development of a **new hotel concept** in all its dimensions that permits the seasonal nature and loyalty of the travellers to be tackled by making the supply attractive and different.

The objective of the Living Laboratory is to analyse trends in behaviour in consumption and user preferences in information technologies, in restaurants and accommodation in specialised environments. It is likewise aimed to use the area of the CAIT restaurant to demonstrate the use of certain technologies generated in the project.

Living Laboratory of modular construction (installation envisaged in the Campus on a plot close to CEDINT). Modular construction systems and tendencies in the use of space. Use of the solar homes used by the UPM in different competitions of the Solar Decathlon (2005,

[29] There is already a specific experience in the UPM with the "Living Lab of applications of the TIC to Health" located at the ETSI Telecommunications and which has been partially financed by the Moncloa CIE. This facility has been sold using several European projects of the Seventh R&D Framework Program of the EU.

2007 and 2009 editions in the USA) although these houses will be used initially as technological demonstrators (see the following section).

Figure 18 shows two prototypes of solar houses built by the UPM for Solar Decathlon (2005 and 2007) and currently located in Montegancedo. Together with the third house used in 2009 in the USA which has a small "photovoltaic hamlet" whose location in a specific place in the campus (together with CEDINT) guarantees its use for specific experiences.

Figure 17. Prototypes of the solar houses of the UPM

Pilot plants and technological demonstrators

The existence of Living Laboratories must be complemented with a series of demonstration technological facilities, in which the knowledge on the already developed technologies may be accelerated although not totally introduced into the market or new processes (in this case, fundamentally by means of pilot plants) in which they may be experimented.

In a more advanced creation process the following technological demonstrators are found linked to the R&D centres in Montegancedo.

- **Technological demonstrator of integrated demotics**: located at the CeDint (Centre for Integral Domótics) it has laboratories that reproduce a home in which technologies linked to the most advanced domotics are experimented.

  The demonstrator allows the consumption and energy saving to be monitored in a home equipped with different domestic appliances, illumination control systems, security, etc. Likewise, it serves as a "showroom" for the exhibition of elements designed by both CeDinT and LPI an associated company whose R&D activity is located in the R&D centre itself).

- **Technological demonstrator for 3D communications. The** UPM has extensive research experience in the design of advanced telecommunications systems in R&D projects within the Framework Program of the EU. This demonstrator has video capture systems, transmission via different media and 3D visualization systems. It currently has prototype systems in the ETSI Telecommunications (3DTV which has a laboratory in the areas of acquisition, characterization, compression, distribution and visualization of audiovisual 3D materials).

  The tri-dimensional television demonstrator (Dem-3DTV) will be mainly oriented at representation and distribution which is an attractive focus for research group and business activities, and active participation in organisations for normalization, mainly in MPEG. The support infrastructure for R&D and the testing of tri-dimensional television equipment consists of

  - Acquisition: system of chambers that allows visual information to be acquired in multiple views.
  - Representation: characterization of the signals that allow their exchange, their storage and their transmission.
  - Codification: reduction in the volume of data necessary to represent the signals and thus achieve both a more efficient storage and transmission
  - Visualization: system of visual presentation of the signals that offers different images according to the position of each observer and allows them to perceive depth and perspective.

- **Pilot plant of the Boeing-LPI photovoltaic concentration system.** There are basically two ways of reducing the cost of photovoltaic energy: the fine layer in which it is sought to reduce the cost of the module, although the efficiency is comparatively low, and the CPV photovoltaic concentration in which very efficient (and expensive) cells are used and an optical system which permits the radiation to be concentrated so that the cost of the cell becomes a small factor within the total cost of the module. The current project is framed within this line of activity in which the UPM has played a large part in the activity through its Institute of Solar Energy[30].

[30] Through the Solar Energy Institute the UPM is building a pilot plant for the purification of silicon for pre-industrial solar cells (up to 50 Tm annually) in the Tecno-Getafe campus. This plant will be exploited by CENTESIL in which the UPM forms part.

In this project it is proposed to implement a pilot plant for the concentration systems developed by Boeing in collaboration with LPI and the Cedint Centre of the UPM. These systems combine the best cells (manufactured by Spectrolab-Boeing) with the best optical concentrators (designed by LPI-UPM) that are currently available. This has enabled these CPV modules to currently hold the world record for efficiency in HCPV (33.6%). Spectrolab holds the world record for photovoltaic efficiency (41.6%) although the cells used for the module in this project are those in production, that is, with an average efficiency of 38.5%. The concentrators are of the XR off-axis type and were designed and made by LPI and UP

The plant will consist of a total of 10 arrays developed by Boeing-SES (five C3MJ and five C4MJ). The dimensions of each array are 2m x 5m. The total production of the installed plant would be 25 kW (2,5kW per array). Figure 19 shows the structure of the arrays and of one of its elements.

Figure 19. Elementos of the fotovoltaica concentration

The development and exploitation of the demonstrator will be tackled from the installation of the plant up until the analysis of the results of the monitoring of the data. The objective of the measurements is to study and model the production of the electrical energy of these modules by placing special emphasis on the evolution of the optical components and how these affect the generation of electricity. The evolution of the optical components is the least known tan that of the rest of the components of the CPV system and therefore the information that it is hoped to extract from this monitoring is especially useful in evaluating the risk of the financing of these systems.

- **Montegancedo astronomic observatory.** This is the first astronomic observatory in the world with free access via the Internet. An observatory of 3.5 metres in diameter. It is completely free to use the system. Although one cannot reserve the telescope, you can see

what is happening in the observatory by means of the four available webcams. Its characteristics are as follows:

1. 10" Meade LX200GPS Telescope.
2. CCD SBIG Modelo ST-237A chamber + wheel of filters CFW-5C.
3. WebCams ToUcam Pro I and II, of which two of them have been modified to take long-exposure photographs.
4. Pro 2 Plus Vantage Meteorological Station with a Fan-Aspirated Radiation Shield. The meteorological data are recorded in a data base.

Figure 20. Astronomic observatory (dome at the Faculty of Computer Sciences)

- **Demonstrators of fourth generation mobile technology**. Still in the negotiation phase, it is the intention of the UPM together with IMDEA software to use the Montegancedo CIE for the development of advanced communications demonstrators of the "Internet of the Future" in which the UPM is working. The installation of the ICT-Labs node of the EIT will be a good occasion to promote the putting into effect of the advanced technologies demonstrators in mobile communications.

3.3.5. Area of strategic management and administration

The development the activities described superficially in the previous sections for each of the areas of the **CAIT** also involve the development of periodic horizontal activities of contact, training and information to potential users, as well as the process of negotiation and the launching of strategic of interest to the UPM in this area.

It is not just a question, in this case, of explicit attention to the R&D activities of the entities already located in the Montegancedo CIE to endeavour that the **CAIT** in fact becomes a place for the location of innovation activities and, expressly for the commercialization of the

technology. For this, we must remember the facilities existing in the new building and already available in the Business Centre: meeting rooms, assembly room, cafeteria, restaurant, etc.

From a virtual point of view the CAIT must use electronic communications systems on the basis of the activity currently existing in the Vice-Rectorate for Research of the UPM with two fundamental activities: R&D observatory (http://www.upm.es/institucional/Investigadores/ObservatorioIDi) and the ActúaUPM program (http://actuaupm.blogspot.com.es/).

Specifically, this area will deal with the following areas:

1. Management of **strategic innovation projects**. A basic function of the CAIT is the putting into effect, together with other entities, strategic innovation projects for the whole of the UPM. These projects are not oriented to developing R&D activities for which there are currently multiple mechanism available[31]. Initially, it is expected to start with the setting up of a "Fund for the Commercialization of Technology" that will be outlined later.
2. Coordination and secretarial services of the **"Advisory Council" of the CAIT.** This council aims to serve as a channel of communications with society from the perspective of innovation and with it be able to attract potential investors.
3. Management of the **UPM Park** in all of its central offices (Campus Sur, Tecno-Getafe and Montegancedo itself), including the institutional relationship with APTE (Association of Spanish Technological Parks). Fundamentally, it will seek the optimization of the spaces of the business incubators, as well as the management of the construction of new services and centres that are located in any of its central offices.
4. Management of the **Montegancedo CIE**[32]. Period issuing of management reports as deemed necessary for the financing public administrations, likewise, the maintenance of the Campus Web page.
5. Maintenance of the **periodical contacts with users and businesses** of potential interest to the objectives of the **CAIT** (organization de visits, meetings, presentations of products or technologies, etc. At the Montegancedo CIE or at other UPM campuses).

[31] Between them the existence of " HYPHEN-UPM projects " whose putting into effect from 2013 will start a new type of activity in the UPM for which the CAIT must serve as a support in the later phase.
[32] The Moncloa CIE possesses its own management and coordination structure.

6. Organization of **courses, seminaries or public presentations** on subjects related to technological innovation or with opportunities for financing it (e.g. calls). It is not a question, in this case, of carrying out regulated teaching activities (as the Official Masters' Degree would be) but of having a permanent training activity.
7. Maintenance of the interactive **Web page** of the Montegancedo CIE, including "newsletters", blogs, etc. Likewise, the drawing up of the dissemination documentation as deemed necessary.
8. Coordination of the presence of the **CAIT** and the activities related to the UPM in forums, conferences, etc. Both in Spain and in other countries.
9. Institutional participation of the UPM in the RedEmprendia, CRUE, RedOTRI, etc. in environments proper to the CAIT.
10. Legal advice and intellectual and industrial protection to the advantage of the priority lines of the CAIT (spin-offs, commercialization of technology, technological projects)

3.4. Construction of the main building

The resources obtained from the call for the Campus of International Excellence as regards the Centre for Support for Technological Innovation[33] has permitted the construction of a building attached to the current Business Centre (each of them connected by a corridor) with the objective of their having a single reception.

The public bidding process took place in 2011 with the company Dragados S.A. winning the contract and starting the construction in September 2011. The construction continues its development with the finish expected at the beginning of November 2012, and its effective occupation at the beginning of 2013. See figure 21 for the state of the construction in May 2012.

[33] The name under which it would appear in the proposal made by the Ministry was CEDET (Centre of Technological Demonstration). The objectives are the same as currently expressed with the CAIT.

Figure 21. The state of the construction work in August 2012 (the building next to the current Business Centre with direct communication between them)

Subsequently, in 2012, it was considered advisable to make an extension to the construction underway to include a space to locate the CIESP with the envisaged financial resources, initially, for a research centre in the construction that was expected to be carried out in the Montegancedo CIE together with already envisaged activities in the Moncloa CIE after an agreement between both universities. From the architectural point of view the building is unique and its reception will be unique. It is envisaged for November 2012.

Apart from the areas of the **CAIT** itself, as previously described, two units that will complement the activities envisages in the Montegancedo CIE in its initial proposal will be located in the building under construction.

- **Centre for HIGHER Studies into Heritage** (mixed centre with the Complutense University of Madrid), including the laboratory for the manufacture if 3D (Fablab) at the School of Architecture of the UPM. With this activity it is expected to accelerate the use of the TIC in the Architecture sector and expressly in the recovery and management of historic artistic heritage. This activity is carried out in collaboration with the Moncloa CIE.
- **Mini-agora**. Common interaction space with a restaurant whose administrative concession will take place during the first trimester of 2013 and which will likewise give rise to a meeting point for the activities of a business nature as well as attention to users which is coming progressively into effect.

3.5. Governance, staff structure and estimated financing

3.5.1. Relationship of the CAIT with the rest of the UPM

As has already been mentioned, the location of the **CAIT** in the Montegancedo CIE does not mean that its activities are carried our exclusively to the benefit of the units established in this Campus. On the other hand, it is expected that the **CAIT** will serve as a **catalyst for a modernization process of the UPM** in the context of the innovative technological ecosystem to which we have made repetitive reference and which contributes decisively to the process of valuing the results of its research activity.

Figure 22 details schematically the relationship of the **CAIT** with other campuses and the **internal context** (made up of units from the UPM, generators of knowledge and technology:

research groups and research centres) and the **external context** (made up of the entities that generate technologies potentially integrated with those generated in the UPM or who can exploit them). The latter context takes on a crucial importance at the moment in which the UPM wishes to construct an environment around it that offers (and is offered) opportunities to accelerate the innovation process.

The management and coordination of the development of the **Scientific and Technological Park of the UPM** (currently attached to the Vice-Rectorate for Research) generated since 2002 is carried out from the **CAIT** given its close relationship with it. With it, it is aimed that the management of the business incubators (both of the Grove in the Campus and that of Montegancedo), the management of the innovation in the Campus Sur or in that of Tecno-Getafe, and the institutional relationship with the Association Technological Parks (APTE) is formally integrated into the **CAIT**.

Likewise, the CAIT must play a relevant part in the consolidation of the **Campus of International Excellence conceded to the UPM**. In the case of the **Montegancedo CIE** this relationship is direct since this Campus was already defined at the time as a "campus oriented to technological innovation" and the CAIT was one of its fundamental actions. Figure 22 makes reference to the **Moncloa CIE**, and expressly to the priority relationship that the UPM has with the UCM in the development if this CEI, with which there is an agreement to use the Montegancedo CIE as a basic element of the support for technological innovation in the actions that come from both universities.

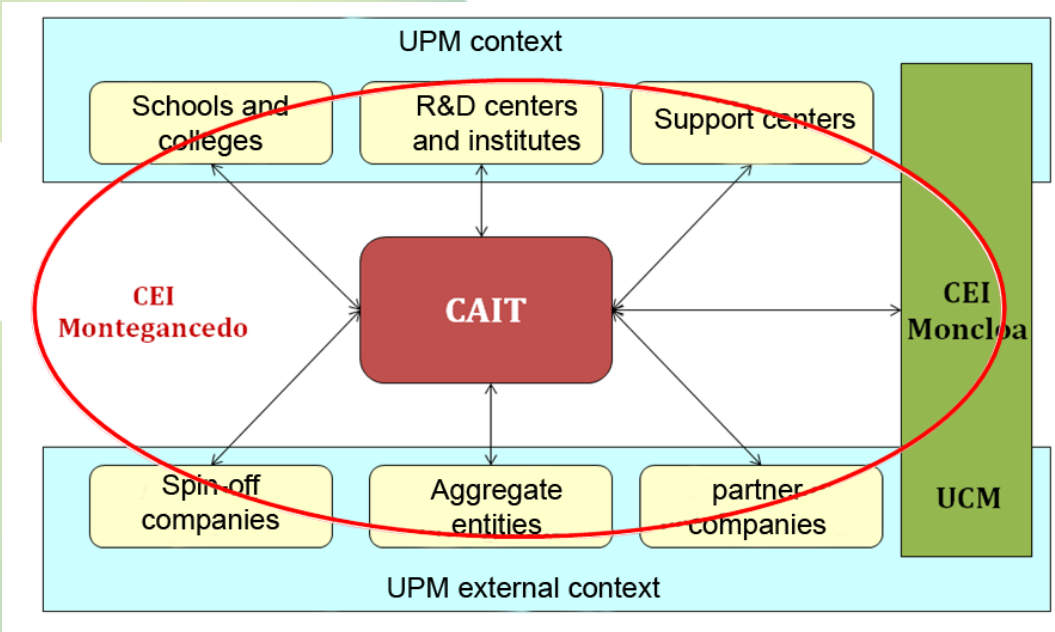

Figure 22. Context of the CAIT

In the internal context, the interaction of the **CAIT** with other UPM campuses for the support for the commercialization of the technologies identified initially can be describes as in table 1 presented below:

Priority technologies in the CAIT	***Ciudad Universitaria* Campus**	***Campus Sur***	**Tecno-Getafe Campus**
Information and Communications	ISOM micro-devices and nano-technological) CEI (electronics of power) ETSI Telecommunications Engineering ETSI Industrial EU Industrial Engineering	Simulation (CITEF) Simulation vehicles (INSIA) CITSEM EU Telecommunication Engineering EU Computer Sciences ETSI Topography (Geomatics)	Software for the simulation of materials
Biomedical and biotechnological technologies	Living lab for health ETSI Agricultural Engineering EU Agricultural Engineering ETSI Telecommunications Engineering CEIGRAM	Centro Laser (applications in medicine) EU Computer Sciences	Not relevant
Energy technologies	IES Institute of Fusion Solar Decathlon ETSI Agricultural Engineering (Biomass) ETSI Industrial Engineering	Laser Centre INSIA (hybrid propulsion) Headquarters of the IES	CENTESIL IES pilot plant (department of silicon) Petro-physics Institute
Technologies architectonic and preservation of heritage	CISDEM School of Architecture ETSI Civil Engineering School of Technical Architecture IDR (aerodynamic tunnels)	CAEND	IMDEA Materials LOM LOEMCO

Table 1. Initial relationship of the CAIT with the campus (and offices in the Park) of the UPM

3.5.2. Governance structure of the CAIT

The **CAIT** is conceived as a **centre of support services to R&D** of a specialised character of the UPM without separate legal entity[34] whose formal approval will be made by the UPM in the next few months[35]. The possibility that the **CAIT** will be able to have its own legal personality may be considered at a later stage inasmuch as it is possible that its development leads to a formal involvement in different entities external to the UPM with the objective of increasing the commitment assumed between them and the UPM.

As there is no specific regulation specific to the development of that articulated in the Statutes of the UPM for *"other centres"* that do not correspond to research or technological centres it is not necessary to make a proposal for the proposer units (in this case a proposal from the Board of Directors of the UPM at the initiative of the Vice-Rectorate for Research).

The **single bodies** proposed are as follows[36]:

> Director: full time PDI member of the UPM appointed by the Rector for a period of four years. He/she will also act as a delegate of the Rector in relation to the Montegancedo CIE.
>
> Manager/ Administrative Director: person from the PAS of the UPM appointed by the Rector at the proposal of the Director of the CAIT for a period of four years renewable. He/she will also assume the administrative management of the UPM Park and of the Montegancedo CIE.
>
> Heads of Area: PDI who collaborate part time with the administration and service staff of the UPM or those contracted by the foundations of the UPM (FGUPM, F2I2) in accordance with the specialisation necessary in them.

The **professional bodies** proposed are as follows:

[34] The statutes of the UPM permits the creation of our own research centres (such as the CTB, CITA-IDR or CEDINT), mixed research centres (such as the CBGP and as will the CIESP be), our own or mixed technological centres (such as the COM), "other centres" such as those support services centres (as is the case of the CESVIMA in supercomputing and as the CAIT will be in support of technological innovation). Likewise, the Statutes of the University permit the UPM to participate in the sponsorship of Foundations such as the case of IMDEA Software.

[35] The envisaged formal creation of the CAIT will be presented to the research Commission in September and to the Social Council and Governing Committee of the UPM at the end of 2013 coinciding with the strategy of the building under construction.

[36] The functions of the single and collegiate governing bodies are developed in the formal documentation of creation that will be presented to the governing bodies of the UPM for its approval. It is aimed to use the creation of currently existing centres as the basis for regulation.

Governing Committee of the **CAIT**: Presided over by the Rector and made up of the Director of the CAIT, Vice-Rector for Research or person delegated for this role, Vice-Rector for Economic Affairs or person delegated for this role, Manager of the UPM, Director General of the FGUPM and President of the Social Council or person delegated for this role. The Manager/Administrative Director of the CAIT will attend with a voice but without a vote.

Its functions will be:

1. Approve the annual budget proposed by the Board of Directors of the CAIT
2. Approve the report on annual activities proposed by the Board of Directors of the CAIT
3. Approve the action plan proposed by the Board of Directors of the CAIT
4. Approve the agreements signed with third entities
5. Appoint and dismiss the Director of the CAIT
6. Appoint the al Manager/ Administrative Director

The Board of Directors of the **CAIT**: made up of the Director, Manager, and those responsible for the areas whose functions will be

1. Draw up the annual and multiannual action plan
2. Draw up the annual budget
3. Implement the actions with the budget available
4. Draw up the annual report
5. Negotiate the agreements with third entities in the lines established in the action plan
6. Draw up the contracting of staff or the reassignment of forces of the UPM or of the FGUPM
7. Distribute and assign spaces

External Advisory Council of the **CAIT**: made up of 10 people (five from the UPM (ex-students or ex-teachers) to guarantee its knowledge, and 5 people from companies or units external to the UPM; all of them appointed by the Rector as proposed by the Director of the **CAIT**). It will be presided over by one of the advisors proposed by the Rector.

With the objective of facilitating the financial management of the external services of the **CAIT** it is proposed to entrust this to the *Fundation General* of the UPM. It must be borne in mind that the FGUPM is currently the promoting and management entity of the UPM Park and is in charge of the financial management of the Business Centre and will be subsumed into the **CAIT**. However, given that part of the staff ascribed to the **CAIT** comes from the UPM itself, it will be necessary to take into account that a percentage of the costs must be met by it.

3.5.3. Staff structure

The staff ascribed to the **CAIT** must be made up of a **reduced set of highly specialised staff** that cover the areas set out in the previous sections together with a small administrative support unit. It must be taken into account that the **CAIT** will not develop technology or scientific knowledge with the staff itself which is why it will not be necessary to incorporate technical staff for it. The activities relevant to the development of specific products, etc. must be subsidised by specific projects that may incorporate or not additional staff contracted for work or service.

The organisational chart represented in figure 23 summarises the structure proposed for the distribution of staff in the deferent areas. The area of **management and administration** assumes in this organisational chart the horizontal work of the **CAIT** andy,specifically, a function associated to the **promotion and management of strategic R&D&I projects** with the business sector to the service of the conjunto of the UPM. The aspects of support and coordination of the participation of the UPM in ICT-Labs and in the COM ecosystem have been incorporated into the figure although in both cases the staff will be linked to the activites that are defined in both activitie.

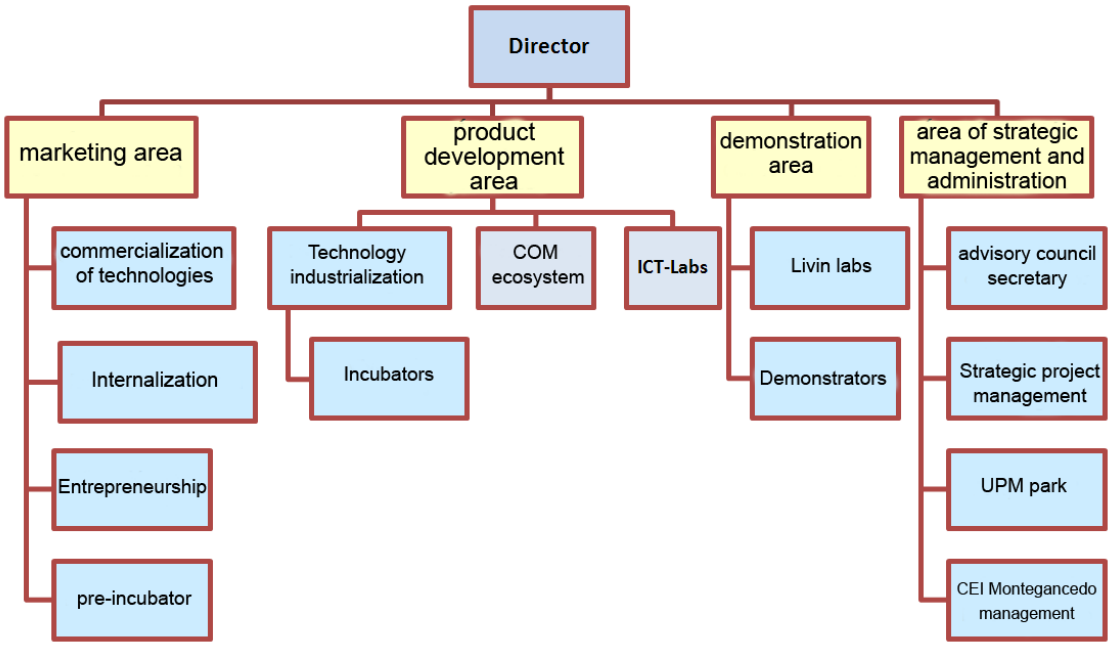

Figure 23. Organisational chart proposed by the **CAIT**

Table 2 schematically summarises the needs of **specialized staff** envisaged during the period 2012-2015 in accordance with the areas described[37] (The Director and Manager or responsible administrator be they PDI or PAS, in the latter case appointed by the Rector, are not included in the table).

Area	2012[38]	2013[39]	2014	2015
Area of management and administration[40]				
CAIT Manager		1	1	1
Strategic projects	1	1	1+1	1+1
UPM Park and CEI	2	2	2	2
Legal Advice		1	1	1
Secretariat	0	1	1	1
Area of Commercialization				
Commercialization of technology	1	1+1	1+1	1+2

[37] Those corresponding to the staff of the COM ecosystem and that which predictively corresponds to the activities of the ICT Labs is not considered in this table on having the staff proper to the aforementioned centres for specific projects financed with its own budgets.
[38] The staff corresponding to 2012 is currently answerable to the Vice-Rectorate for research (be they contracted by the UPM or by the FGUPM).
[39] The incorporation of these staff (or the contracting of equivalent services) will be carried out during 2013
[40] The current staff of the UPM Park are included in this area (other staff have been included in the attention to the client already based in the Montegancedo Business Centre and contracted through the FGUPM).

Internationalization	0	0	1	1
Creation of businesses and pre-incubator[41]	4	4	4	4
Area of product development				
Industrialization	0	1	2	2
Ecosystem COM				
Area of demonstration				
Demonstrators	0	1	1	1
Living Laboratories	0	0	1	1
Total	**8**	**14**	**18**	**19**

Table 2. Evolution of the staff needs of the CAIT (in **blue** of the currently existing staff, in **red** the staff financed by activities and in **green** the staff coming from the re-assignation of staf coming from other services of the UPM)

The additional staff required (in red) during the period 2013-2015, 3, 7 or 8 people respectively (human resources not in the accounts in the current situation nor existing in other services of the UPM) must be financed by means of the resources that are obtained through activities taking place in the CAIT and that will be presented below. Their contracting will be, therefore, subordinate to it.

In any event, the possibility that part of this staff cost will not come from just individual contracts made by the UPM or by the FGUPM but coming from the **contracting of services with external businesses or consultancies** will be analysed. This formula, even though its cost may be similar (it will considered thus later on) has two considerable advantages: 1) to be able to access qualified staff part-time is difficult by means of direct contracting, and 2) the elimination of commitments to continue the contracts in situations in which external incomes do not permit it. In some cases, depending on the service, it will be possible to establish a system of variable payments to contracted businesses or entities in accordance with los results achieved by each activity.

3.6. Financing

The development of the **CAIT** has benefitted initially from the financing obtained in the calls for the Campus of International Excellence in the years 2009, 2010 and 2011 by the Ministry of Education (currently the Ministry of Education, Culture and Sport) and that of Science and Innovation (the latter integrated into the current Ministry of Competition and Innovation) for the Montegancedo Campus. This financing has permitted the construction of the headquarters building of the **CAIT** as well as the equipping of some of the Living Laboratories that are initially installed in it.

[41] In table 2 the corresponding sub-area has been separated with the objective of seeing the origin of the staff.

3.6.1. Estimated incomes

Nevertheless, its later development beyond the initial financing indicated will require the existence of additional resources to guarantee not only the costs but also provide incomes to the whole of the UPM. Specifically, its incomes will come from the following sources identified to date:

1. A percentage of the resources obtained from royalties or licenses for use of the technologies generated in those in which the **CAIT** has intervened. It is continued suitable for 50% to correspond to the UPM, the **CAIT** can have 20% for its intermediation[42].
2. Resources coming from businesses installed in the Business Centre or in the **CAIT** itself for the use of its services (currently it is the FGUPM who receives these resources).
3. Contribution to the general costs of overheads for activities the R&D centres installed in the **CAIT** (initial case of the CIASP)
4. Resources coming from the percentages for the management of the Commercialization Fund which is obtained from external investors on the commercialization of the technologies.
5. Financing of the business associated chairs (at the moment there are two, FDI and Clarke, Modet&Co, but there could be additional ones in the future).
6. Financial support for the Actúa-UPM program for collaborating entities
7. Annual quota from the businesses associated to the UPM ecosystem of innovation in accordance with the benefits obtained from its membership.
8. Horizontal financing of specific projects that are obtained from public or private calls related to the objectives of the **CAIT**.
9. Resources coming from training courses given, seminars, workshops or business presentations.

These resources are going to cover the costs of the working of the **CAIT**, including its fixed staff, activities and consumption by means of the annual budget established by the Board of directors and approved by its Governing Council.

[42] It is considered that this scheme will permit the contracting of external staff or services that significantly increases the revenues through this concept proper to the UPM.

Table 3 describes schematically the estimated revenues in the period[43]:

Budgetary Heading	2012	2013	2014	2015
Resources obtained through royalties and licences for technologies promoted from the CAIT[44]	0	0	50,000	150,000
Businesses installed in the Business Centre and CAIT (rents)	150,000	180,000	200,000	250,000
Percentages of investment in the development of products promoted from the CAIT (Commercialization Fund)	0	40,000	80,000	100,000
University-business Chairs	30,000	30,000	90,000	100,000
Actúa-UPM Program [45]	100,000	150,000	200,000	200,000
Annual quotas from the businesses or entities adhering to the ecosystem CAIT	0	50,000	100,000	150,000
Financing of horizontal projects specific to the CAIT by the AAPP private investors	0	80,000	250,000	350,000
Giving of courses and seminars	0	20,000	50,000	50,000
Totals	**280,000**	**550,000**	**1,020,000**	**1,350,000**

Table 3. Estimated evolution of the revenue budget of the CAIT (in Euros)

For orientation purposes, the **CAIT** should, at the end of the period, achieve an **estimated annual financing** of more than **€1,3M** for the purposes of consolidating the objectives that have been set out in this document. It supposes, therefore, a substantial increase in respect to the current situation in the UPM.

Within the incomes included in Table 3, it is considered very important that the UPM by means of the **CAIT** is able to achieve the creation of a **"Fund for the commercialization of technology"** obtained by means of contributions from national and national investors. This fund should act as an *"endowment"* (managed by the FGUPM or by a risk capital management company in accordance with the result of a legal analysis that is implemented) with that which can be invested in the development of products and the pre-incubation of technological businesses which are two basic elements of the activity of the **CAIT**. It is not a question, therefore, of the investment of risk capital in already constituted businesses which should follow a differentiated scheme in which the UPM will not intervene.

The objective pursued is that amounts of less than 100,000 Euros be invested in the development of technological products whose base technologies have been identified as promising by the commercialization area of the **CAIT** or in pre-business projects which within a

[43] The resources obtained in the OTRI or ULAB programs that the UPM currently receives and that in the first of the cases it is used for the payment of staff nor considered in this table.
[44] Two years of margin has been established for the obtaining of resources deriving from this activity.
[45] The cost of the contracted staff has been considered, premium and organization of events.

period of one year may generate a new technology-based business. It should also help to complete the processes for the protection of the technology as deemed necessary.

€1M is considered to be the minimum amount in the fund which could be contributed by 6-7 investors. With these resources a total investment into 10-15 technologies is estimated possible within a period of three years. The fund must be recovered within a period of 3 years from its investment with a small remuneration (around 7% annually) coming from:

- A percentage from the sale, licences for use or royalties for the exploitation of the technology developed with financial support of the Fund.
- A percentage of shares in the case in which the business project in which it has invested has generated the corresponding spin-off.

In any event, the incomes obtained from the activities financed should mainly serve to maintain the level of the Fund and be reinvested in new projects.

In table 3 several amounts of incomes for the management of the Fund of €40,000 (2013) have been estimated, with an investment of €400,000, of €80,000 (2014) with an investment of €800,000 and €100,000 (2015) with a total investment of €1M which would assume the reaching of a stable state from this year.

3.6.2. Estimated costs

A first valuation of the **proposed estimate of costs** necessary within the period of 2012-2015 is detailed in Table 4.

Budget Heading[46]	2012[47]	2013	2014	2015
staff[48]		100,000	300,000	350,000
Consumption[49]	80,000	150,000	180,000	200,000
Communications	0	10,000	20,000	30,000
Organization of events	20,000[50]	20,000	30,000	50,000

[46] Possible investments of the Commercialization Fund which will have a separate accounting has not been taken into account.

[47] The staff corresponding to 2012 se is currently answerable to the Vice-Rectorate for Research and does not appear in Table 4 as it has current resources for its financing (concession of the MINECO or UPM or FGUPM staff).

[48] The average annual cost has been estimated for each necessary person contracted as €50.000 for the first two years and a little more for the third. The staff originate from the re-assignation of staff have not been considered.

[49] The heading of consumption has really been entered into the accounts from 2013 assuming that the occupation of the building takes place in 2013. In any event, the small heading of 2012 has been carried out by attending to the costs of the current Business Centre.
The costs for security, vigilance and cleaning are included in this section (extension of contracted staff of the current Business centre) and the consumption of electricity, gas and water.

Pre-incubator	0	40,000	80,000	150,000
Actúa-UPM[51]	80,000	100,000	150,000	150,000
Demonstrators	0	30,000	60,000	100,000
Product development	0	50,000	150,000	200,000
External services[52]	0	30,000	50,000	50,000
Totals	**180,000**	**560,000**	**1,020,000**	**1,280,000**

Table 4. Estimated evolution of the budgetary needs for the costs of the CAIT (in Euros)

The amounts that appear in 2012 correspond to the consumption in the current Montegancedo Business Centre and the cost necessary for the implementation of the Actúa-UPM program.

From 2013 the real activity of the **CAIT will commence**. A balance has been procured between incomes and costs (tables 3 and 4) without the UPM having to establish a working budget additional to the working of the **CAIT**[53] with the exception of the budgetary headings for the return of the loans for the construction of the building at the AAPP not contemplated in the Tables nor the staff themselves whose costs currently already exist. The estimated amounts for demonstrators and product development refer to installation costs and will be subordinated to the signing of agreements with organizations for the financing of its later operation.

4. Conclusions

This document has described the justification and main characteristics of the **Centre for Support for Technological Innovation (CAIT)** as an essential part of the development objectives of the **Montegancedo Campus of International Excellence**.

The starting position of the UPM, set out in the figures presented in this document demonstrate a great capacity for applied research in relation to the business sector which, however, has not been accompanied by results in their direct exploitation which has, therefore, a long way to go.

With the setting up of the of the **CAIT** (both in its conceptual formulation and its physical presence in the new building constructed next to the current Business Centre) it is expected to

[50] In2012 the resourced to this end originating from one of the associated chairs has been entered into the accounts. It is a question, in any case, of events and documentation proper to the launch of the CAIT:

[51] The cost of contracted staff, premiums, and the organisation of events is considered proper to business competition

[52] It will also cover the cost of secretarial services and meetings with the Advisory Committee

[53] It will disappear, likewise, the budget of the Business Centre.

cover a series of activities which must accentuate a substantial change in the way in which public universities deal with the exploitation of their R&D results and the creation and support of the business ecosystem built around them.

The areas of activity of the **CAIT** that have been described in previous sections go on from a series of pilot experiences that have been initiated in the past two years. Some of them, with initial successes that advise their stabilization and strengthening into a stable structure like the one that is expected.

The work plan that will be necessary to develop is intense. The need to develop an **"innovative technological ecosystem"** associated with the UPM in areas as diverse as those that are dealt with by the different schools, faculties, R&D&I centres and university research institutes, require a progressive process and specialized in the different areas. The experience that was initiated with the ecosystem associated with the al *"Centre for Open Middleware"* is going to permit its activity to be extended to many other technological areas.

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