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Knowledge transfer from the innovative university. A model of information management in the digital context: the PIEDD case study

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Abstract

To continue fulfilling the imperative need to generate and transfer knowledge and innovation, universities must meet the growing demands of a society that is undergoing an unstoppable process of global digital migration. In this sense, since its creation in 2009 to the present, the *Platform for Innovation and Experimentation in Digital Diversity* (PIEDD) of the University of Santiago de Compostela has carried out R&D projects in technology innovation and vocational training in the context of design, generation and management of all kinds of digital content, which constitutes a pioneering experience of collaboration between almost one hundred prestigious researchers working from as heterogeneous and concomitant disciplinary fields as computer sciences, ICT, applied physics, mathematics, journalism and audio-visual communication and advertising.

Keywords: Content industry; Digital formats; Information Management; Innovative University; Media.

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1. Introduction: an innovation model in heterogeneous information management

The *Platform for Innovation and Experimentation in Digital Diversity* –hereafter, *PIEDD*– of the University of Santiago de Compostela –hereafter, USC– carries out R&D projects of excellence in technology transfer and vocational training in each of the development phases of digital content, thus assuming the challenge of the innovative university in the digital era (Beetham; Sharpe, 2013).



First of all, this type of platforms, as such, are the main model of innovation and not precisely the leading projects it develops (Autor1, et al., 2016): constitutes a pioneering and innovative experience of international and interdisciplinary collaboration between almost one hundred prestigious researchers –based on the quality, number and impact of their publications– that are part of eight research groups affiliated to the USC’s Faculty of Communication Sciences, the School of Advanced

Engineering, the Information Technology Research Centre and the Technology Research Institute, as well as their associated networks of international researchers.

This model of technological innovation, added to the demands of emerging professional profiles in communication fields (Salaverría, 2016), requires an equally innovative model of information management –both personally and collectively– able to face the convergence of huge data clusters due to the inevitable collision of formats, information targets and architectures, idiosyncrasies of their content and personal profiles: otherwise, it is inevitable that its remarkable volume of researchers suggest their disciplinary approaches in a radically divergent form, within the framework of a transdisciplinarity understood as a synergistic collaboration between two or more disciplines with high levels of integration between the disciplinary sets of knowledge (Leavy, 2016, p. 9).

This, then, is the main role of PIEDD: to break down the barriers, to question all limitations and to relegate to the past any kind of unilateral paradigm in order to make the communication process not only interactive, but also truly co-interpretative and co-expressive, as well as emphasize the growing importance of interdisciplinary research at the intersection between higher education, creative industries and growth of regional creative economies (Comunian; Gilmore; Jacobi, 2015).

In this sense, let us also emphasize how our acronym, PIEDD, evokes –in the English etymology of the term “pied”– a concept of “multicolorism” that literally defines the vocationally transdisciplinary character of our Platform. Through this tireless purpose of self-transformation, PIEDD endorses the undeniable demand of every innovative university, following the Christensen and Eyring way of thinking (2011): to change the DNA of higher education from the inside out.

Since its creation in 2009, PIEDD works actively in collaboration with the public and business sectors in the development of knowledge and technology transfer projects, applied to multiple socio-economic sectors, and in the generation of entrepreneurial business initiatives, especially in the case of those companies that, for different reasons, lack opportunities for the development of their own labs, as a formula for innovation in the media, according to the Salaverría model (2015). In the same way, the Platform develops training activities focused on satisfying the curricular demands of the academic sector and the continuous training needs of companies from the digital sector.

Moreover, the institutional framework that hosts this innovative technology-based platform is ideal: in fact, USC, with more than five hundred years of academic experience –founded by Lope Gómez de Marzoa in 1495, is one of the oldest universities in the world: http://www.usc.es/en/info_xeral/historia/index.html–, is an institution that looks to the future and acts beyond its natural borders, always attentive to the needs of the society of the territory in which it carries out its research, academic and education work.

In fact, of all the research funding received each year by the USC, two thirds come from public institutions and one third from contracts with private companies. In the last decade, the USC has ranked in the top ten national and international institutions with more patent applications, and with the highest revenue from patents (De La Torre; Agasisti; Perez-Esparrells, 2017).

In this context, PIEDD, as a corporative project of the USC, was configured in the wake of the “Digital Professionals” state programme (www.profesionalesdigitales.es) and actually became the first project to obtain funding from this programme through a public competition scheme: Pluri-regional Operative Programme for Spain “Knowledge-based Economy”, in line with the objectives of convergence, competitiveness and employment established by the European Commission.

2. Objectives: goals for an innovative experience of interdisciplinarity

One of the main criticisms often made to universities is their low permeability to the demands of the environment in which they overlap. Overcoming this obstacle demanded a thorough analysis of potential users and beneficiaries, in order to meet real-time demands of a complex social environment, instead of just the traditional assessment profile public and private competitors, with a precise objective: to transform the media and cultural policy into a public policy, following the perspective of Hesmondhalgh (2005).

Based on the experience of the different research groups, the guiding objectives of PIEDD were configured in response to three requirements detected in its sociocultural and economic environment:

1. The conditions of opportunity emerging in the development of the audiovisual and multimedia sectors at Galician, Spanish and European levels (Autor1, et al., 2016).
2. The need to create a new academic framework to develop training programmes that are innovative, interdisciplinary and closely linked to the reality of the audiovisual sector (Blau *et al.*, 2015).
3. The need to give researchers from the USC a new environment capable of enabling the development of synergies between the scientific-technological and socio-economic fields, in order to optimise the strategies of cooperation and technology transfer in relation to the industry and institutions, according to the triple helix of Etzkowitz and Zhou (2017), essence of Silicon Valley's success.

Based on these requirements, it was established that the activities of PIEDD would be guided by the following three main objectives (Autor1, 2012):

1. As its central objective, PIEDD aims to be a dynamic entity of reference for regional, national and international companies and institutions, in all the stages of the process of experimentation, production and innovation in the field of digital content.
2. To drive the sector through a permanent dialogue about its strategic planning, a strong technology transfer and the joint development of R&D projects.
3. Training and updating of professionals in the field of digital content, through an education plan that balances the requirements of the academic curriculum and the specific demands of the industry. In this sense, in addition to offering a wide range of regulated new curricula, PIEDD's training plan covers a set of actions directly demanded by the sector, in the form of specialisation and postgraduate courses, in the framework of continuous training and updating of professionals throughout their entire cycle of work activity.

3. Composition: a complex organization with a common goal

With regards to the research groups that integrate and co-founded PIEDD, they saw the platform as an opportunity to direct their technological background and knowledge towards the more immediate socio-economic and cultural context, in an integrated, multidisciplinary and cooperative manner, and all this framed in the new communicative ecosystem that, day by day, is defined by the new digital media (Canavilhas, 2015).

To materialise this ambitious goal, USC put together eight research groups that were consolidated in the field of digital content and were carrying out technological and socio-communicative activities based on “participatory transdisciplinarity” (Mobjörk, 2010), trying to optimize the historical

development and present form of multi-, inter- and transdisciplinary studies of media and communication (Briggle; Christians, 2017, p. 201).

In fact, PIEDD researchers carry out their teaching and research activities mainly at the Faculty of Communication Sciences and the School of Advanced Engineering, which together offer all of the undergraduate and graduate programmes of the USC in the field of digital content.

The best way to show the amplitude, complementarity and rigour with which the USC has carried out research in the field innovation and experimentation in digital content is to provide a brief outline of the research groups that are part of PIEDD: Artificial Vision Group, Audiovisual Studies Group, Citizenship and Communication Group, Computer Architecture Group, Intelligent Systems Group, New Media Group, Systems Laboratory and Computer Graphics and Data Engineering.

Here it is important to highlight, as a faithful reflection of the relevance and intensity of the relations that these research groups maintain with the sector (entities, companies, sectoral associations and platforms), their active participation in the different organisational and R&D structures (professional and sectoral associations), particularly those related to the Galician technological platforms of the audiovisual and ICT sectors (Kopcha; Rieber; Walker, 2016).

4. Methods and technological instrumentation

The question is simple: once established the guiding objectives, what is the best way to manage huge masses of heterogeneous data? Or, in other words, how can different formats of information be articulated without becoming a sort of unmanageable “Tower of Babel”?



Due to the profuse heterogeneity of research groups and disciplinary areas involved in PIEDD, it is impossible to limit oneself to a single methodology. Therefore, the grouping assumes a synergistic and operative workflow systematics that, in each new project, integrates multiple methodologies. Therefore, in terms of its “Competitive Structure” (Peppard; Ward, 2016), PIEDD has established five equally-important and perfectly coordinated units that ensure the appropriate development of the R&D projects and technology training activities in the entire value chain of all the existing and emerging digital morphology:

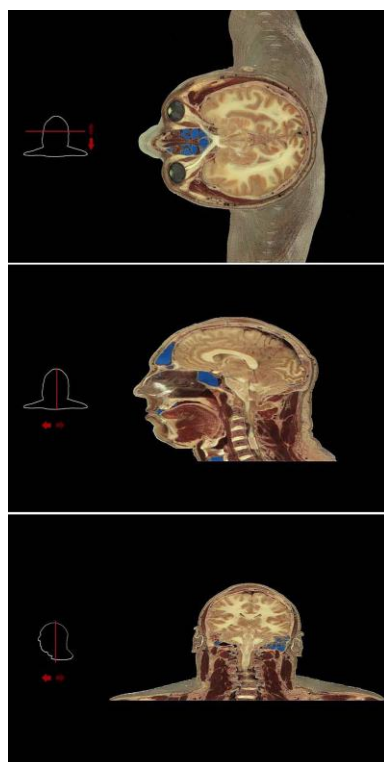
1. Technology Training Unit: unit that provides support to the technology training actions with two classrooms each with 21 working stations, equipped with the professional hardware and software needed to CGI 3D animation, digital production and postproduction, advanced visualisation, video games, etc.
2. Innovation and Experimentation Unit: its potential revolve over an advanced and autonomous virtual U-shaped studio, with large Chroma key flooring, monitored HD cameras and equipped with Brainstorm Multimedia for CGI 3D real-time graphics and virtual set solutions.
3. Advanced Visualisation Unit: modelling and animation of sets and characters, kinetic capture and lip-synching, completes the multilayer synthesis between CGI sequences and real images, incorporating FX layers. It is equipped with a two-sided CAVE (an immersive virtual reality system), a movement capture system and a rendering station.
4. Video Game Unit: focused on the video games world, develops prototypes and proofs of concept of video games, as well as the generation of new narrative spaces and original interfaces for the different morphologies of platforms.
5. V-Learning Unit: is focused on the joint development of innovation activities in v-learning, mainly in cooperation with companies dedicated to the generation, management and access of virtual content for education at different levels.

5. Projects and awards: consolidating an innovative model for the future

The platform of the USC continues to consolidate its proven experience in the development of R&D projects in the field of digital content, in fields as diverse as virtual reality, culture and leisure, education and v-learning, management and circulation of content and media convergence.

To better illustrate PIEDD’s commitment, here is an outline of some of our most emblematic projects, according to the aforementioned thematic areas: “Advanced information search in Blogs for the prediction of trends” (Díaz-Hermida et al., 2009), “*Immersive visualization systems*” (Flores, et. al., 2010), “*Portico of the Virtual Glory*” (Autor3 et. al., 2012), “Europe’s Small-Scale Audiovisual Media Markets and Minority-Language Film Industries” (Ledo-Andión; Autor2; Autor1, 2014), “Advanced sensorization of Virtual TV sets” (Autor3 et. al., 2015), “System for the extraction of geographic entities associated to television news” (Luaces, 2015), “Advanced visualization and interaction applied to virtual scenarios” (Autor3 2017), “Cinema: diversity and networks” (Ledo-Andión; Autor1, 2013), “Natural interaction in virtual TV sets through the synergistic operation of low-cost sensors” (Autor3 et. al., 2017), “eDCINEMA. Towards the European Digital Space” (Ledo-Andión; Autor2; Autor1, 2017), “New distributed virtual TV set architecture for a synergistic operation of sensors and improved interaction between real and virtual worlds” (Autor 3 et al, 2018) ...

As it has been commented previously, one of the main pillars of PIEDD is training. In this sense, besides the organization of courses, the direction of PHD and master theses and the coordination of internships in institutions and companies, PIEDD has focused on improving its training efforts by making use of different learning innovations. An example of these innovations are the different service learning projects that have been implemented since 2015, achieving different awards and quality seals such as the *Innovation award* by the Galician Agency for Organ and Blood Donation, the 2018 seal of the *European Year of Tangible and Intangible Cultural Heritage* by the European Council and the *Creative Talent* seal given by Injuve (Spanish Youth Institute).



Another aspect particularly addressed by PIEDD has been the generation and tutelage of entrepreneurial initiatives, better known as the promotion of spin-off companies, which are developed at the core of the university by the most outstanding students and, after a period of tutelage by the University, gradually become independent and full-fledged companies. These “emerging companies” are selected and managed from the *perspective of business competition* proposed by Rasmussen and Wright (2015).

To this end, as part of its Strategic Plan, the USC founded Uninova (www.uninova.org), which is a true business incubator for innovative technology companies located at the heart of the three international campus of excellence of USC: Campus Vida, Campus Terra and Campus da Cidadanía.

In this context, two technology-based business initiatives have been developed by PIEDD researchers. The first initiative, *Moonbite Games SL*, resulted from the collaboration between researchers from PIEDD and the film production company *Continental Producciones S.L.* This initiative focuses on multiplatform development and implementation of emotional intelligence techniques in interactive games.

Paralaxe Multimedia and Virtual Systems is another spin-off company created in the USC. This company develops a large number of interactive apps for museums, combining formation and leisure through the use of new technologies and the experimenting with three-dimensional interactive environments and a clear commitment to innovation techno-creative in “Serious Games”.

With regards to the awards received by both spin-off companies, we can mention two important awards that highlight its brief yet intense trajectory:

1. *Mestre Mateo Award* for best interactive work (original adaptation for mobile devices), awarded by the Galician Audiovisual Academy to the company Continental Producciones, Systems Laboratory of the USC and the spin-off company Paralaxe Multimedia Virtual Systems.

2. *Second Prize for Innovative Business Projects of the University of Santiago*, awarded to Moonbite Games S.L. for its cross-platform products and its innovations in emotional intelligence in virtual environments, as an empathetic resource between console and player.

6. Training: commitment to excellence at all levels

As previously mentioned, one of the priority areas of PIEDD is training, both as part of the university curriculum and as a response to the specific needs of the digital content sector. In this regard, it should be emphasized, as a common denominator of all training activities developed, the evidence of specialization as integration of knowledge and not as a partial fragmentation of knowledge. Some of the most relevant training actions undertaken by PIEDD are:

a) *Organisation of courses*

- *First Brainstorm International Master Course*. With the assistance of operators and developers of virtual sets from Argentina, Brazil, Chile, Korea, the United Arab Emirates, India, Mexico, Peru, Portugal and the United Kingdom, this course led offered an intensive training on the enormous operating potential of Brainstorm eStudio 12, EasySet 12 and Easy On Air Graphics.



- Summer course “Artificial Intelligence: Science, technology, fiction or marketing?”. This course feature a roundtable on the future of the digital contents and several related conferences, such as “Modelling the knowledge on the Web” and “Artificial Intelligence in social networks: the A.I. 2.0”.
- “Advanced course on virtual environments operation and design”, this course was delivered by a speaker of Brainstorm Multimedia at our virtual studio. People taking this course were trained in environments as diverse as *EasySet*, *Designer* and *eStudio*.
- *Course on electronic graphics in Maya*. This course goes into details about the Maya interface and its enormous techno-creative potential: animation, polygonal and NURBS modelling, lighting, rendering, etc.
- *Masterclass on the workflow with Adobe Creative Suite*: Bridge, Illustrator, and Photoshop as multimedia authoring tools; creation of animations, interactivity and games with Flash; non-linear video editing with Premiere; content creation with Motion Graphics and visual effects with After Effects.

b) *Direction of doctoral theses and master’s dissertations*

Currently, PIEDD members have conducted two doctoral theses focused on neuromarketing and road safety (Freire, 2013), and about the design a scalable sensor system for virtual TV sets (Autor3, 2017). Both doctoral theses are being co-directed by professors from the Faculty of Communication Sciences and the School of Advanced Engineering:

In addition, several dissertations related to the digital context are being developed by students of the *Master's Degree Programme in Communication and Creative Industries* and *Master in Journalism and Communication: New Trends in Production, Management and Dissemination of Knowledge*, both of the above at the Faculty of Communication Sciences, and the *Inter-university Master's Research Programme in Information Technology* at the School of Advanced Engineering.

c) *Internships*

One of the means to intensify the professional training of students of Computer Engineering, Journalism and Audiovisual Communication is the practice of internships in companies and institutions which have collaboration agreements with the university. Thus, during the last academic year, several students of Computer Engineering and of Communication Sciences did their internship in leading companies in the digital contents sector: these figures do not include the students doing internships in traditional companies or media, which are already over two hundred in the Faculty of Communication Sciences.

7. Problems found and lessons learned

Since its creation in 2009, PIEDD has become a stable alliance between different and multidisciplinary research groups and a platform from which they can launch their different projects with diverse points of view and unifying strengths.

Perhaps the most revealing lesson in this transdisciplinary collaboration time becomes overwhelmingly obvious: every cooperation process requires knowing and respecting each other, overcoming fears and prejudices, and being able to handle the different technical language and work routines of the various knowledge areas involved.

As the most important mean of communication between people, PIEDD members faced linguistic problems that they hadn’t even thought about. For example, during a meeting between communicators

and computer engineers, there was a situation of confusion with the term “Delphi”, which could be considered an emulation of the biblical story of the “Tower of Babel”: as it is known, for social scientists, Delphi is a prospective statistical method based on a questionnaire sent to a panel of experts (Mohedano, 2013), while computer engineers (Shevchenko; Bychkov; Shevchenko, 2017) refer to the term as an Object-Oriented Programming language (OOP) and its Integrated Development Environment (IDE). Thus, it took a while for the meeting participants to realize the confusion and explain the meaning of the term to the other part.



Regarding the specificity of the work routines, during the development of the finally successful project “Virtual Portico of the Glory of the Cathedral of Santiago de Compostela” (<https://goo.gl/AfLKuK>), there had to be overcome iterative tensions between groups of audiovisual communicators –that insisted in the prevalence of the audiovisual content– and the historians –defending the integrity of their texts against any adaptation to the environment–, or computer engineers, determined to exhibit the potential of the ad hoc designed software.

Undoubtedly, we recognize that overcoming all these difficulties made it possible for us to forge our ability to address increasingly complex technological projects, covering as diverse socio-economic interest areas as education, health sciences, tourism, road safety, environment, data science, cultural industries, dissemination and enhancement of historical and artistic heritage, etc.

However, one of the limiting elements of PIEDD projection nowadays is its insufficient internationalization, which we are confident to overcome in the short term, since we are aware that this limitation has a negative impact on our university autonomy, according to the lucid explanation of Turcan and Gulieva (2016). Indeed, most of our R & D projects and technology transfer contracts are confined to the Spanish country, which determines the size and scope of our objectives.

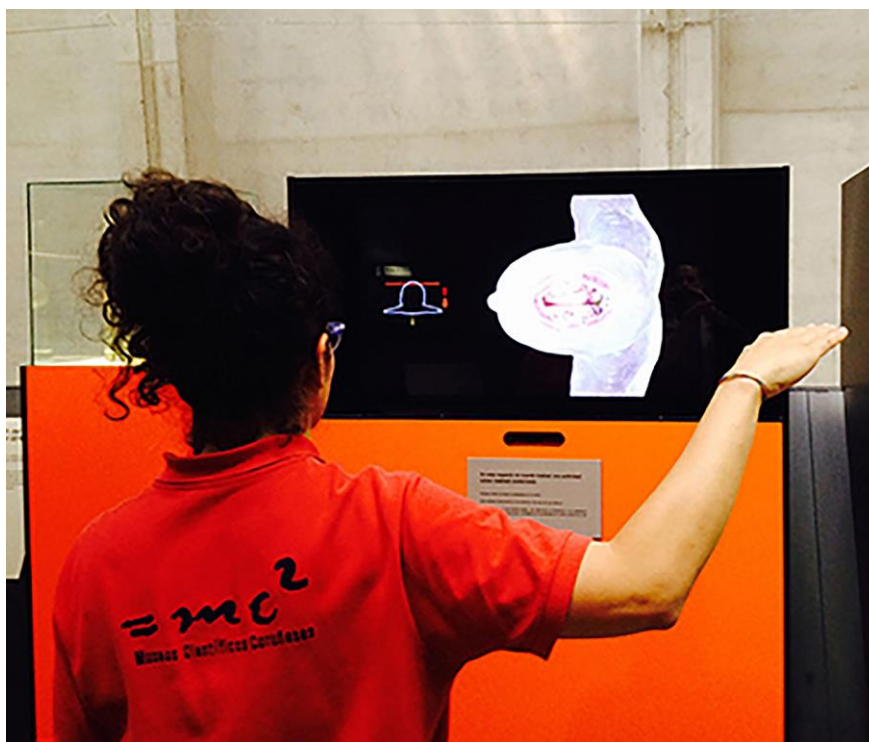
8. Conclusions: innovation and knowledge at the service of media society

The title of the final section of this document aspires to some overcoming of the traditional motto of USC: “Knowledge at the service of society”. After having described the main features of PIEDD, let’s focus on this society whose demands have increased in the new global digital context: in this sense, the multimedia convergence and integration into the universal network of information requires a constant renewal of agreed standards, both for the production and dissemination of content (be it information, persuasive content or entertainment).

This convergence also creates a vicious circle, in which the emerging technologies radically change lifestyles and consumption habits and by doing so force the creation of new digital formats that seek the satisfaction of the new niche markets (Feijóo, 2013, p. 6). We are talking about the potential of media and platforms that, like the interactive multimedia content, lack technological and expressive borders, capable of creating absorbing and alternative atmospheres that reinforce the plausibility of the story through the analogy with certain referents, like the generation of “possible worlds” clearly taken out any referential slavery.

As mentioned elsewhere (Autor1, 2012: 234), the ubiquitous term since the dawn of digitisation was “integration”: thus, the development of interactive multimedia technology pointed towards an inexorable integration between so-called multifunctional transmitters and multimedia receivers.

The contemporary socio-cultural environment demands the university to establish wide and “inclusive” trans-disciplinary approaches that are close to the concept of “consilience” which, as updated by Edward Osborne Wilson (1998) based on the work of William Whewell (1794–1866), refers to a “jumping together” of knowledge from the sciences and the humanities.



On the other hand, we also expect an intense technology and knowledge transfer to the cultural industries (both old and emerging) which will create new niche markets and alternative diffusion models at a moment in which their demand becomes dramatic since the widespread crisis of the contemporary economic model has triggered in turn the crisis of the audiovisual production and exploitation models which had been brewing for decades.

Indeed, the profound and urgent geopolitical, socio-cultural, techno-economic and historical rethinking of the status quo prevailing in the field of media and communications since the second half of the 20th century is demanded by the modification of consumption habits, the massive technological access, the digital migration and interactivity (Domínguez-Martín, 2015), the rapid obsolescence of formats, piracy and the deterioration of intellectual property, the collapse of advertising spending, the difficulty to recover the high costs of audiovisual production, the crisis of the mega-media groups, the opening of alternative media consumption niches, the precariousness of the journalistic profession, the collapse of state interventionism and a long etcetera.

Apart from the current vicissitudes in the audiovisual sector, the crisis has overflowed the economic boundaries, compromising the legitimacy of citizens' axiological values and the validity of their expectations. Thus, the mistrust of Western citizens in the political classes (whose ranking has increased in the list of social problems, along with the economic crisis, unemployment and terrorism) and the proliferation of civil disobedience movements like "15M" (which was emerged and developed thanks to the social networks and the ubiquitous technologies) has transmuted the conception of essential public interest, which is one of the factors that define the media in the past (Autor1 et al., 2016, pp. 285-286). An increasing number of population targets, starting with the youngest targets, perceive the massive and indiscriminate agenda setting of the conventional media as completely alien and seek their own sources of information in the "vicinity" of the social networks.

This is, therefore, a process favoured by the spread of digital technology that, by multiplying the alternatives of distribution and consumption, appears to be responsible for the unrest taking place in the traditional cultural industries, which is a real subversion of the financial model that had supported the cultural industries since their inception: imagine, for example, the unstoppable replacement of the exhibition model in movie theatres by other alternative forms that do not guarantee the return of the huge monetary investments that are essential to sustain the current production model (Díaz; Gómez; Molina, 2017).

So the mission given to the *Alma Mater Studiorum* by the media society in which it is inscribed is: to break down the barriers, to question all limitations and to relegate to the past any kind of unilateral paradigm in order to make the communication process not only interactive, but also truly co-interpretative and co-expressive: this, then, is the main role of PIEDD.

In this way, the platform of the USC continues to consolidate its proven experience in the development of R&D projects in the field of digital content. As mentioned in the introduction, despite the still short history of PIEDD, its researchers have led or participated in more than thirty R&D and technology transfer projects, which together have received more than one million Euros in funding since its creation in 2009.

Before concluding, let us insist on the fact that this work is a comprehensive analysis of an innovative university experience in information and knowledge transfer and not precisely the leading projects it develops (Autor1, et al., 2016), as a corollary to the scientific and technological contributions that have been highlighted up to this point.

- **Funded research:** this paper is focused on the PIEDD experience, which began its journey within the framework of the project "Capaciación Tecnológica de los Futuros Profesionales de la Industria de Contenidos Digitales", reference 2009/PC2016, funded by the "Ministerio de Industria y Comercio, Red.es, and Plan Avanza".

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