ICT ART CONNECT

ACTIVITIES LINKING ICT AND ART: PAST EXPERIENCE – FUTURE ACTIVITIES

FINAL REPORT

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Digital Agenda for Europe

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ABSTRACT

The study "ICT ART CONNECT: Activities Linking ICT and Art: Past Experience - Future Activities" reveals further evidence for the integration of the arts as an essential and fruitful component within research and innovation in ICT. It connects communities of artists and researchers at all levels, including institutions, companies and individuals, and it has given origin to a new online platform. STARTS – Science, Technology and the Arts brings together artists and researchers to creatively innovate in ICT. The study presents artists' critical but constructive approach to technology with close-to-market outputs, a strong common focus towards social innovation, linking research and science communication to new social and educational platforms. The multidisciplinary and hybrid approach with technology as common ground blends research and artistic practices into tangible outcomes and results. Partnership with industry focused on mutual beneficiary collaborations is generating disruptive but structural and concrete results and is thus becoming a new standard in innovation management. The hybrid and nomadic community of ICT and arts is expanding rapidly over Europe. Building on successful stories and projects, it can be enabled to redefine research, innovation, social change and education on a wider and more permanent base in the coming years.

1. EXECUTIVE SUMMARY

MOTIVATION

Innovation is about starts. A constant eruption of new beginnings resulting from the creative disruption of established thinking. This is exactly what artists are very good at: criticising the establishment and formulating new problems. The constant appropriation of new technologies by artists allows them to go a step further in actively participating in society. By using ICT as their expressive medium, they are now able to prototype solutions, create new products and to make new economic, social and business models. By using traditional mediums of expression and thinking about the potentials of ICT they propose new approaches to research and education.

The European Commission is recognising the emergence of vital arts and research communities who work jointly on unique uses of technology. The result is ICT ART CONNECT: Activities Linking ICT and Art: Past Experience - Future Activities. The study, by means of qualitative research, reveals new evidence for the integration of the arts as an essential and fruitful component within research and innovation in ICT. The underlying aim of this study is to contribute to enhancing creativity and innovation in society, technology, science, and education. The ICT ART CONNECT study has connected communities of artists and researchers at all levels, including institutions, companies and individuals. In sequence with previous actions and in coordination with ongoing projects promoted by the European Commission, it has given origin to a new online platform named after the new DG CONNECT initiative. STARTS – Science, Technology and the Arts brings together artists and researchers to creatively innovate in ICT.

KEY FINDINGS

To think out-of-the-box is a well-known objective in innovation processes. Artists, however, are more interested in getting rid of the box. It is this disruptive approach that is seen has fundamental to create a **critical approach to technology** and technological developments. One interviewee even expressed the opinion that the integration of artists in technological research processes can be instrumental for the attribution of meaning to new technologies. A solid critical approach is fundamental for competitiveness based in knowledge and creativity. Results of art and technology research projects are in their majority in the form of proof of concept. Knowledge is materialized in concrete applications and very often including usability testing in their in early stages. Results are therefore often in the form of **close-to-market outputs**.

A recent study found that the culture and creative industries (CCI) contributed with 4,2% of GDP of Europe in 2012. The majority of the total revenue is attributed to the visual arts, well above advertisement and TV. **Innovating artistic practices** can be instrumental to increase competitiveness transversely in the **growing digital single market**. Another study tells us that 90% of current data was produced in the past 2 years. Artists have been engaging in very productive ways in dealing with this data. The area of **information visualisation** is a growing one and helps us to better understand this exponentially growing amount of data. In this way, artists can also contribute to research and development. Many artists have been at the **origin of new technologies**. The example of the Berlin-based company ART+COM is key. The company created the Terravision system in 1994 that many consider to be the prequel to Google Earth. It can be said that the artistic origin of one of the most successful worldwide on-

line platforms lies in Europe, but was commercially explored elsewhere. More recent examples may go the same way – Eduardo Miranda has for example developed the new bio musical computer, the full potential of which could certainly take some time to be unveiled.

Projects such as the open hardware platform Arduino also show how artistic practice can lie at the basis of later technological developments with a tangible economic and societal impact and as such play a crucial role in the ever increasingly important field of **social innovation**. They have a concrete impact on the growth and jobs objective by enabling more people to experiment with open source digital technology. This exponentiates the probability of the creation of new products and services and contributes to socially driven innovation processes which distinguish the EU from other players in the global markets. Aside from social innovation, artistic actors can also foster **innovation in research** itself. The recent discovery of the oldest cave paintings in the world allowed us to better understand the importance of practices of art in development of the capability of abstraction of human beings. Abstraction is considered to be the main enabler for innovation in science and technology.

As such, the integration of artists in scientific practices can go well beyond the important field of **science communication**. The context of science museums is where a relevant number of art, science and technology collaborations have been taking place. These projects join scientists and artists in order to better communicate scientific achievements. But the role of artists goes much further. Artists have been developing new methods and **new organisms for education**, which they often prefer to refer to as learning. Many of these models allow for a better implementation of ideas such as transdisciplinarity, hybridity of competences and holistic approaches. By implementing these actions into educational models, e.g. at masters' level, they contribute to better knowledge transfer from academia to industry, as is the case with Aalto University. Implementations at PhD level, such as the Planetary Collegium, contribute to what was coined by another study as the Third Industrial Revolution that positions the EU as the place for highly qualified competences.

Introducing artistic practices in companies or research departments in the field of ICT stimulates a context in which employees or researchers are urged to experiment with new ideas, technologies and materials in new **collaborative contexts**. This has multiple advantages; it leads to unforeseen innovations on a short or longer term (serendipity), develops social and communicative skills of the participants and results in a stronger team spirit and better productivity.

ART IN RESEARCH & INNOVATION: SOCIETAL AND ECONOMIC IMPACT

The analysis of successful project stories focused on cases where interaction between artists-researchers and other IT experts was especially enhanced and had concrete impact on innovation and creativity in Europe and worldwide. These cases form good practice-based evidence of how integration of the arts in research, development and innovation can lead to real progress in the field of ICT. This points at the sound reasoning behind some of the main worldwide references in engaging with the arts and design for social and economic innovation processes based on ICT, such as the National Endowment for the Arts, the agency of the US Government responsible for innovation in the arts, and the STEAM strategy for successful innovation in the US – Science, Technology, Engineering, Arts and Mathematics.

From a methodological point of view, the concept of best practices, foreseen in the study's proposal and work plan was, after input from the Advisory Group, transferred to the concept of successful project stories. As the field is vast and wide, the mapping of successful stories resulted in interesting views of the community towards the process of creation and their own understanding of success. Facing questions on what success means to the community and why projects were considered to be successful, the outcome generated a comprehensive framework upon which a model of Best Practices can be devised. Through custom-made software, correlations between aspects of the stories were established to define common grounds. In itself, the approach is an example of the integration of the artistic methods in research: an interactive graphics program was used to systematise the data in analysis, in opposition to being simply used to illustrate or visualise analytics.

> *"Artists should be incorporated as catalysts for new ways of thinking, not only about art, but about the world we live in, to change the way things are done, made and developed in the world."*
> Quote from the FET-Art project, suggested by Camille Baker, Media Artist/Researcher/Curator (Advisory Group member)

THE EMERGING HYBRID FIELD OF ICT AND THE ARTS

The study involved intensive stakeholder consultations in reaching the different objectives, by engaging the advisory group as well as by integrating community crowd-sourcing aspects in its web presence, for example by a qualitative in-depth survey. An interactive map application was integrated with the survey approach and as such shows some of the main inputs of relevant stakeholders, crowdsourced from the community itself. The community was asked to participate through peer-to-peer contacts, interviews and open calls on social media platforms and mailing lists. The emerging community of practitioners in the mixed field of arts and technology can be described as hybrid and nomadic. While the respondents to the survey describe themselves more as artists than ICT-orientated scientists and engineers, it is clear that there is a subset of respondents with specific technical skills that may enable them to expertly and fluently navigate the specificities of the fields or ICT as well as arts. This specific community can be interesting to look at in terms of strategic support for development, as concrete results may emerge easily from these 'hybrid creatives'.

However, as the example of STEM to STEAM in the US illustrates – from Science, Technology, Engineering and Mathematics to including A for Arts – innovation does not only emerge from ICT and STEM related skills, but also from arts and design in itself. Only integrating arts in ICT related research when arts are ICT-based in themselves would not sufficiently open up traditional STEM methodologies for fostering creativity and innovation. In this respect, a warning against instrumentalism emerges from the community consultation. The survey characterising this emerging hybrid field contains quotes pointing out the need for 'the focus on invention and experimentation without being trapped by the economic outcomes', the risk of art being 'used as a poor justification of purely scientific projects', or only used 'to generate new commercial products and services'. Any successful strategy or implementing artistic approaches in ICT R&D funding will have to take this into account as a crucial minefield of sensitivity in the artistic field. The call for openness emerging from the field – open structures, open platforms, inclusion and open definitions – echoes the ongoing discourse of open innovation in the specific light of including arts as an engine for innovation.

"Artistic expression brings to ICT key dimensions for innovation, sensitivity, context awareness, transdisciplinary integration and freedom of design."
Hugues Vinet, R&D Director, Ircam (Advisory Group member)

POLICY OPTIONS AND RECOMMENDATIONS IN THE CONTEXT OF HORIZON 2020

From the analysis, recommendations can be drawn for a DG CONNECT strategy to engage more broadly with the arts in H2020. Aside from the instrumentalism risk, a main need of the communities is to be made aware of the role of the European Union both in policy making and funding mechanisms. The survey responses hint at the fact that, even though the community is highly used to collaborative and project-based work, potential key players are often not aware of the available opportunities.

A main aim of the website that will outlive the end of the study can therefore be to inform the communities about developments in the area of opportunities. Related to this, we can also expect that training will be needed in order to prepare relevant agents from the art field to face the bureaucratic level of funding application processes in the ICT domain. An umbrella meta-project to promote smaller projects could be instrumental in this initial phase, in analogy with recently launched sector-specific programmes coordinated by intermediate organisations in the context of Future Internet technologies.

A main challenge will be to combine artistic creative freedom with technology transfer processes. The survey points out tensions between the need to be cutting-edge versus the risk to be too new; the need for being open and flexible versus standard project needs of having well- defined targets. Balancing these tensions as well as foreseeing financial support will be instrumental to build a sustainable field of practice.

In light of this, a **number of strategic scenarios** are possible. These scenarios are not necessarily exhaustive and could be implemented at the same time. One approach is to fund artistic activities in the context of ICT research projects with a fixed percentage of the overall project cost. This is similar to what is put in practice, for instance, in public building in some countries like the UK: 2% of the overall cost of the building is invested in public art. This could be a good transition option, but it runs the risk of, as quoted in the survey, art being 'used as a poor justification of purely scientific projects'. As such, it may not be sustainable and it may also not sufficiently foster the significance of concrete inputs to innovation from artists-researchers.

A second strategic approach could be to allow for the recognition of artistic research as a valid practice in the production of knowledge, i.e. on the same level as recognised scientific and engineering practices. In this case, artists-researchers, or teams of artists and technologists or ICT specialists, could for example be evaluated on their technological capacity and potential towards innovation, similarly to current practice with other experts in ICT proposal evaluation. Combining both options could for example lead to a scheme whereby as an initial incentive, the inclusion of artists-researchers in project teams could count as a (small) positive factor in evaluation.

A third option is to ensure that the acceptance of works of art and exhibitions as research outcomes would be standardised at a EU level, i.e. generalising this practice as it happens in some EU member states. A well-considered implementation of options such as these could be instrumental for the nourishing of the emerging field of ICT and arts in the European Union.

> *"Art works can put meaning and values into physical form."*
> Olafur Eliasson (Advisory Group member)

FURTHER METHODOLOGICAL NOTES AND PARALLEL ACTIVITIES

Full methodological elaborations as well as further findings and recommendations are to be found in this final report. In addition to this, it is worth pointing out that the study was represented at 8 events, including round tables and exhibitions, mostly but not exclusively in Europe. The round-tables were used as both consultation and promotion mechanisms. All parallel activities were integrated in already existing events in order for the study to make a bidirectional direct translation between concrete action grounds and policy-making environments, further underlining the hybrid methodology used in the study with stakeholder consultation by means of the online map and survey, advisory group as well as open discussions at events such as these.

A key example was the event at Ars Electronica, in Linz, Austria, the renowned festival that congregates one of the biggest communities in the field. The study also organised its own symposium in the context of the Bozar Electronic Arts Festival. The event included an exhibition of an open call for project stories that was specifically launched for the occasion, and results from the Art&D program of iMinds were also presented in the symposium and in an exhibition.

> *"It is common knowledge that the future is unpredictable. However, if you intend to contribute to the emergence of our future, then art will serve you as a vital beacon."*
> Alexander Mankowsky, Futurologist & Trend Researcher
> at Daimler AG, Stuttgart.

2. HISTORICAL CONTEXT OF ICT AND ART

The co-existence, symbioses or interaction of artistic practice and science has been undergoing all sorts of transformations and mutations depending from which side or moment in history one looks at it. Being linked with each other, a balance between the conceptualisation and (re)use of both, has seldom been found. Similar to Vitruvian's 'form- follows-functionality paradigms', both practices are too often conceived in a strictly functional approach.[1] This chapter tries to frame some interesting interaction in the evolutions between science, ICT and Art.

With the prehistoric pictorial expression of mankind in cave paintings, a first marker was set. As Pallab Ghosh, science correspondent for the BBC puts it after the recent cave painting findings in Sulawesi:

"*The ability to produce art was an indication that humans had begun to think in more abstract terms. It is a thought process that has enabled us to come out with the science and technology that enabled our species to become so successful*."[2]

Abstract thinking paved the way for technology that steered science into more fundamental research. Other than in Plato's mimesis approach, it triggers artists to dig deeper in reality as we see it, process it and translate it by all, and more specifically technical, means. A reality that became crystal clear through the scientific approach of lenses and pigments by Vermeer or Van Eyck.[3] Renaissance artists, mastering a broad variety of skills, were able to become hybrids, incorporating the *Uomo Universalis* idea typical for that time. Applying, to our standards low-key technical features, their lives and oeuvre were a quest of ameliorating their techniques to transform reality to a canvas. Building further on tradition they were able to master (forgotten) techniques because it fitted in the profile of the 'experimental-artist'.

The use of artistic input in a technology driven society, as we know it from the beginning of last century, can be depicted as an undercurrent of relevance and necessity.[4] With a vast, rapid and overwhelming scope, technology became the factual and literal engine of research and development in most scientific environments. Whether technology was used as a tool or as a goal, a major technical wave of new opportunities boosted R&D in labs and other research environments.[5] More overwhelming than developments in other centuries or linked to former society-changing inventions such as the use of gas for lighting or private postal services, the technical shift steered by the democratic access to electricity and thus the first bits and bites experiments that followed it, caused a radical revolution in the speed, outcome and expectations of research. The power of mechanics and scientific research, demonstrated in unseen demolitions of WOI

[1] Ingeborg Reichle, "Art in the Age of Technoscience: Genetic Engineering, Robotics, and Artificial Life in Contemporary Art", SpringerWien, New York, 2013.
[2] http://www.bbc.com/news/science-environment-29415716
[3] Stephen, Prince, *Through the Looking Glass: Philosophical Toys and Digital Visual Effects*, Journal for Movie and Mind, 2, 2010.
[4] Helga Nowotny, Peter Scott and Michael T. Gibbons, " Re-Thinking Science: Knowledge and the Public in an Age of Uncertainty",Polity Press, Cambridge, 2002.
5 David Egerton, "The Shock of the Old: Technology and Global History Since 1900", Profile Books, London, 2008.

and WOII, fostered reflections of 'sciences for the good' or 'art-humanities science collaboration'.[6]

Witnesses from the first line, such as military rocket scientist and kinetic artist Frank Malina, became aware of the necessity to merge knowledge from science and artistic thinking, hence also of the need to rethink the borders of countries or research institutes, to foster society focussed innovation. This correction of the overall positivism that science and technology would be changing society for the good and forever, was driven out of philanthropic or artistic visions shared by scientist and artists in the early '50s.

"But we are delivered over to it (technology) in the worst possible way when we regard it as something neutral; for this conception of it, to which today we particularly like to do homage, makes us utterly blind to the essence of technology". (Heidegger, The Question Concerning Technology, 1954)

Knowledge based and knowledge driven society needed to be altered into a more sustainable surrounding seeking fruitful and constructive solutions for the challenges of the future.[7] By amending and adapting innovation from military or scientific innovations towards artistic practice and vice versa a hybrid practice was the direct result. Seeking mobilization between traditional research centres inhabited by mathematicians, physicists and chemists and alley-alike artist studios, cross-fertilisation was key.[8] During the aftermath of the depressive times of post World War II crisis, the art world walked further on former unbeaten tracks backed by other social emancipatory movements of the sixties. Getting detached from surface, context or formal expectations, artists embraced science and techniques as a form of expression. [9] Other than photography, which became part of the artistic canon by the end of the 19th century, digital and technological tools became a modus operandi, a method and canvas at the same time. Supported by the first makers' movements, technology and development were for a lot of people a studio or garage DIY practice. [10] Coding and hardware development was practiced in homes as well as in traditional research facilities.

Creativity and technology met each other as well in music-orientated environments. The transformation of technology into sound engineering, became tangible in cooperations such as Yahama or Phillips, research such as John Chowlings FM synthesis at Stanford in 1967, research institutes such as IRCAM founded in 1970, stage acts such as 'Nine evenings: Theatre and Engineering' by Billy Klüver in 1966 or artworks such as the Pepsi Pavillion in Osaka in 1970. Using and adapting technology to answer questions and broaden musical expressions, thus generating new insights in technology, a stronger hybrid

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[6] Anouar Abdel-Malek (ed.), "First International Seminar on the Transformation of the World: Science and technology in the transformation of the world", The United Nations University, Belgrade, Yugoslavia, October 1979.

7 Peter-Paul Verbeek, "What Things Do: Philosophical Reflections on Technology, Agency, and Design", Pennsylvania State University Press, Pennsylvania, 2002.

[8] David Lyon, "The Information Society: Issues and Illusions", Polity Press, Cambridge, 1994.

[9] Marga Bijvoet, "Art as Enquiry: Toward New Collaborations between Art, Science and Technology", Peter Lang Pub Inc, New York, 1997; Gabriell Rockhill, The Janus-face in politicized art: Interview with Jacques Rancière, " The polictics of Aesthetiscs", Jacques Rancière, Bloomsbury Academics, 2000.

[10] Dane Stangler and Kate Maxwell, "DIY Producer Society, Innovation", MITJournal, 2, 2012,

generation put ICT&ART on the agenda. Although not primarily pinpointing 'digital music' as their main focus, classic composers such as Boulez strongly believed in the ability to change traditional approaches towards music through technology.

The changes in electronic music were totally unforeseen, especially since I began planning IRCAM and the Ensemble in 1969. But the computer invaded everything, from the analysis and the synthesis of sound to the manipulation of instruments. (Pierre Boulez, Paris New music Review, 1993)

Starting as an architect, Xenakis, saw the opportunity to translate his creative views on buildings and music with technological means. His idiosyncratic view on modern technology in music was based on a more traditional *universitas* approach mixed with more contemporary philosophers such as Andrew Feenberg.[11]

"It seems that a new type of musician is necessary, "an artist-conceptor" of new, abstract, and free forms, tending towards complexities, and then towards generalizations on several levels of sound organization. … The artist-conceptor would have to be knowledgeable in such varied domains as mathematics, logic, physics, chemistry, biology, genetics, paleontology (for the evolutions of forms), the humanities and history; in short, a sort of universality, but on based upon, guided by and oriented toward forms and architectures."
(Iannis Xenakis ,Art/Sciences, 1985)

Medialabs, facilitating technical knowledge and support, popped out in the US and later on in Europe. While in the first place they often focused on image and video, the ability to access ICT driven technology on a more democratic level, shifted their scope step by step to digital applications.[12] Within these structures, pioneering experiments were made just for the sake of exploration of the limitations of technology or driven by looking for forms to give expression to an artistic need. Self supported or partially founded by the government, these labs became research hubs themselves and/or were created within the borders of university structures through pioneers of the first hour such as Otto Piene or Nicolas Negroponte.

"Stop thinking about art works as objects, and start thinking about them as triggers for experiences." (Roy Ascott)

Having their roots in the conceptualism of the '70s, artists such as Roy Ascott were able to tear down traditional walls of the art practice with research on interactive artworks where the focus was shifted from the object or subject of art towards the Consciousness about it. As in the discourse of contemporary philosophers such as Gilles Deleuze and Felix Guattari, working on the `deterritorialisation' of the human body in the digital area, Ascott's work aims to reposition, question and foster a contemporary human identity.[13] As founder of The Planetary Collegium in 1994, his "technoetic" research, could spread around different nodes and affiliations around the world, stimulating hybrid thinking that includes spiritual aspirations to art, ict and science research.

[11] Michael Hamman, "On Technology and Art: Xenakis at Work" Journal of New Music Research, Swets & Zeitlinger, Lisse, 2004.
[12] Nicolas Negroponte, "A 30-years history of the future", TED-ex March 2014 (http://www.ted.com/talks/nicholas_negroponte_a_30_year_history_of_the_future)
[13] Francois Dosse, "Gilles Deleuze and Félix Guattari: Intersecting Lives", Colombia University Press, New York, 2012.

Peter Weibel also originating out of a 'traditional' artist movement as Wiener Aktionismus, embodied the hardcore anti-art approach by (other than his former colleagues) staying away from traditional art forms and embracing emerging technologies as canvas. Understanding the opportunities of media as mass communicator and interactive tool to deconstruct the formalism of art, Weibel, searched for new applications of available tools in his art works since the eighties.[14] Questioning the current state of contemporary art in a grand discourse on the place of media art brought Weibel to teach and publish at different institutions and universities, thus becoming one Europa's most acknowledged curators.

With the adaptation of the Internet from a military structure to a publicly available platform, a new wave of hybrids took the stage.[15] The first days only a handful of technical skilled believers influenced the development of the Net. Users and philosophers such as Jürgen Habermas and later on Manuel Castells saw the possibilities of the revitalisation of lost or suppressed democratic rights, creating a new public sphere where public and freedom of speech and expression was key.[16] Net-artists wanted to communicate on equal grounds and were self-assuredly staking to their collective goals and ideas without being marginalized or controlled. Building, leading and structuring the boundaries of the Net, technicians and hackers *avant la lettre* saw their creating and responsibilities in a wider sense of citizenship and artistic development. Experimenting with communication technologies and coding the first products of these cooperations provided fuel to all major current ICT technologies from search engines to file sharing or social media applications. Eastern Europe and Russia were at that time crucial to the development of the Internet as an artistic medium, fostering media centres such as Open Society in Ljubljana – home of pioneer Vuk Cosic- where enthusiasts participated in software development. In the mid '90s, as a counter movement to the white-galleries and neo-conceptualism of the art sector, leftist intellectuals, tech whizzes and artists began congregating at online nodes such as The Thing, Echo or Nettime. Through Äda, formed by webcurator Benjamin Weil, contemporary artists such as Lawrence Wiener or Jenny Holzer were invited to experiment with the Internet and digital surroundings.[17] Hacking, as in retrieving access to public phone booths at King's Cross station where strangers could call in to chat with random people passing by these booths, created social anarchic artworks.[18]

Under pressure of various factors, the link between science and ICT was always precarious in the last decades of the 20th century. The use of technology in wars such as the Vietnam War made some artists that started with a primary interest or experiments with ICT revert to traditional standards.[19] Different experiments with embedding artists in industrial settings had lead to a too strict 'instrumental'

[14] Hans Belting and Bazon Brock, "Peter Weibel: The Open Work 1964-1979" Hantje Catz, Berlin, 2008
[15] Rachel Greene, "Webwork: A history of internet art", Artforum, 5, 2000.
[16] Pieter Jan Valgaeren, "Social Media: the position and of users in a new public sphere", (dutch) in Paulus Van Bortel, "We and the Media, Critical reflections on media, truth and trust", Pelckman, Antwerpen, 2013.
[17] Rachel Greene, "Webwork: A history of internet art", Artforum, 5, 2000.
[18] Christine Nippe, "City Representations in Net Art", Ulrike Bucher, Maros Finka, "The Electronic City", Berliner Wissenschafts-Verlag, Berlin, 2011.
[19] Douglas Dodds, V&A Pattern: Digital Pioneers, V&A press, London, 2014.

approach, which generated an overall negative perception towards participation. The art market, having to deal with numerous 'hard to exhibit' and 'hard to understand' art movements such as 'arte povera' or 'conceptual art', wasn't ready to deal with this wave of ICT-based art. As a pendulum reaction a new wave of figuration, formalism and "aesthetics' saw its birth in studios and galleries.[20] With a more formal approach towards the divide of 'liberal arts' and 'applied arts', craftsmanship – also related to ICT – was not necessarily part of the art scene. A more stringent and exclusive IPR system, in which software law and patent law saw a substantial rise, made it harder to access technology for artistic use.

Nominating creative industries as 'new and evolving industries', proposing them as one of the counter actions against unstable economic times and crises, a new format was created towards ICT&ART projects. From a, sometimes, instrumental perspective, cooperations and sponsorship models were pulled up to use artistic input in industry, science or technological development.[21] A great deal of interesting and tangible results could be presented that had a commercial and sometimes even societal outcome. But too often the instrumental approach has resulted in single direction cooperation, leaving the artist empty handed. A balance between use, re-use, IP rights or return on investment for the artist was seldom found, giving the term 'creative industries' a negative aura. This resulted in the quest for other more equitable forms of the use of creative thinking in science and technology.

Since the beginning of this century, the ICT sector started to have an interest in incorporating new ideas from art theory and contemporary art into computer science. Whereas early practitioners of 'digital art' only shared the use of ICT, in some cases just incidentally digital, a new generation is now "occupying aesthetic territory".[22] Groups of artists and/or researchers find themselves in new nodes of participation. Interdisciplinary research institutes such as Aalto University, informal networks such as Leonardo, structural nodes such as Roy Ascot's 'Planetarium Collegium', ZKM or Ars Electronica embody the wide variety of participation modes.

[20] See: Uta Grosenick, Burkhard Riemschneider "Art at the turn of the Millenium", Taschen, London, 1999.
[21] Mike Michael, Brigid Costello, Julie Mooney-Somers and Ian Kerridge "Manifesto on Art, Design and Social Science - Method as Speculative Event", Leonard, MIT press journals, September, 2014.
[22] Stephen Wilson, "Information Arts: Intersections of Art, Science and Technology", MIT press, Cambridge 2002.

3. MAPPING THE ICT & ART CONNECT COMMUNITY

One of the main aims of the study is to provide an overview of institutions and individuals engaged in artistic practices within ICT research projects in Europe. The term 'mapping' can be understood in the sense of creating a general overview of the field, as well as in the literal sense – visualising the relevant stakeholders on a map. As such, this chapter is divided in two major sections: it reports on a survey conducted within the study (3.1), as well as on the map that was established on the online platform (3.2).

The relevance of mapping activities is very high. Although a considerable number of studies and surveys have been conducted in the field, they normally concern the domain of a single country or a narrower field and cannot be found together in one European overview. One of the main missions of the study has been to congregate existing data in one single platform and to enrich this data further by means of the top-down and bottom-up methodologies described in this chapter.

3.1. Mapping the community through a survey

3.1.1. Methodology

The purpose of this chapter of the study can perhaps best be described as **quantifying, qualifying and visualising the field.** The methodology that was put forward at the inception of this study included mainly **desk research** to arrive to an overview of existing sources as a departing point of the mapping, as well as the development of the online components needed for the visualisation and the map overview.

However, this study has put forward the Advisory Group as an important sounding board throughout its duration. The project proposal foresaw a limited survey, to allow the online community to give input on best practices, but during the project's initial stages and first advisory group meeting, a more thorough need for *quantifying and qualifying the field* emerged. As such, a **more in-depth qualitative survey** was set up. An overview of the survey questions can be found in Annex I. Quantitative statistical research was not the main purpose of the survey: many of the questions are open-ended and will not provide answers suitable for statistical analysis. Qualitative in-depth insights were prioritised over a high number of potential respondents, which would potentially be suitable for statistical overview but poor for generating further insights. Due to the qualitative nature of the survey and the amount of open-ended questions, a high item non-response was expected and indeed oberved, which further hinders the suitability of the data for bivariate statistical analysis.

However, some interesting descriptive indications were expected and have indeed emerged when we look at each question individually, as the section describing the results will indicate. The number of respondents to the question being discussed is mentioned (n=X) whenever analyses of this nature (e.g. graphs) are shown. The survey and its many open ended questions allow for an organic approach to qualifying the field: the terminology and wording used by the respondents of the survey will give us valuable insights into some of the key characteristics of the field. In the next section, we will illustrate the richness of our data to qualify the field by means of concrete examples, clustered as well as non-clustered, and also by means of literal quotes from the survey's responses.

3.1.2.Results

As described above, the scope and depth of the survey has widened substantially in comparison to what was originally foreseen. Moreover, to enforce the bottom-up character of the research to the greatest extent possible, the survey was kept open for as long as possible. The online mapping and visualisation input was also welcomed throughout the duration of the study. Some first preliminary results and characterisations of the input we had received were already analysed and described in the interim study report. This section will update a lot of these insights and add new findings based on the survey results. Unlike the mere mapping of registered users, the survey was specifically aimed at gaining information on background and skills, Once again, a crucial **disclaimer** is that the survey is qualitative in nature. As such, aside from the limited applicability of statistical analytical tools, another important factor is that we cannot make statistical generalisations that are valid for the entire population of stakeholders engaged with the crossroads of arts and ICT. It is worth pointing out that this was never foreseen or intended in the study's initial proposed plans.

3.1.3. Self-descriptions of the field

As stated above, some interesting indications of the fields are nonetheless available when we look at the responses received. A first factor worth describing is that the bottom-up information provided via the survey, as expected, gives an indication of the **vast variety in the field** of stakeholders relevant to the study and hence reinforces the validity of the decision of allowing in-depth, more qualitative insights to form the core of the study.

An example can clarify this. Allowing open-ended answers to an, at first instance, mundane question such as "place(s) of work" may have as a disadvantage that the responses cannot easily be quantified in a simple statistical overview table. However, the preliminary results confirm our hypothesis that this is outweighed by the **huge advantage of richness of data that can now be used to qualify the field** and to gain in-depth insight. First, the answers to this question (n=106) give an important indicator of the **nomadic character** of many individuals involved in the field. Answers such as '*many countries*', '*variable*', '*international*', '*Local-Global*' as well as lists of several different cities in different countries (and sometimes even continents) are fairly common. Moreover, the open nature of this question also allows us to ascertain that, at least with the answers available at the time of writing this chapter, **institutions are not the spontaneous answer for the majority of respondents** when you ask them about their place of work. This prevalence of geographic locations might be caused by the phrasing of the question, or it may also be related to the fact that the respondents' affiliation has already been asked for explicitly at an earlier stage of the survey. But it is still worth noting that 58,5% of respondents who have answered this question refer to geographical places, and only 36,8% to the institutional setting(s) in which they work. In the latter case, the nomadic character can still be present, with one respondent even naming 17 different institutional settings. 6,6% of respondents lists terms such as freelance or independent, sometimes combined with a geographical location.

Nonetheless, we can find some defining factors even in the huge variety of respondents. First, the respondents of the study are **incredibly highly educated**, with a hugely disproportionate amount of PhD degrees especially noteworthy (almost 35% has a PhD degree or is in the process of working towards one). Aside from this incredibly high prevalence of PhD degrees and trajectories,

almost all other respondents have Master and/or Bachelor Degrees or equivalents (MA, MSc / BA, BSc).

A second and highly crucial finding is the **prominence of art**. The survey has garnered slightly more interest from the 'pure artistic' side than from the 'pure ICT' side. On a 9-point-sliding scale to position the respondents' *work* from ICT (1) to Art (9), nobody has felt inclined to choose answers 1 to 3. The 'slightly more artistic middle ground' score of 6 and the right in the middle score of 5 are the most popular options, but overall, the balance is firmly towards the arts, as the graph illustrates.

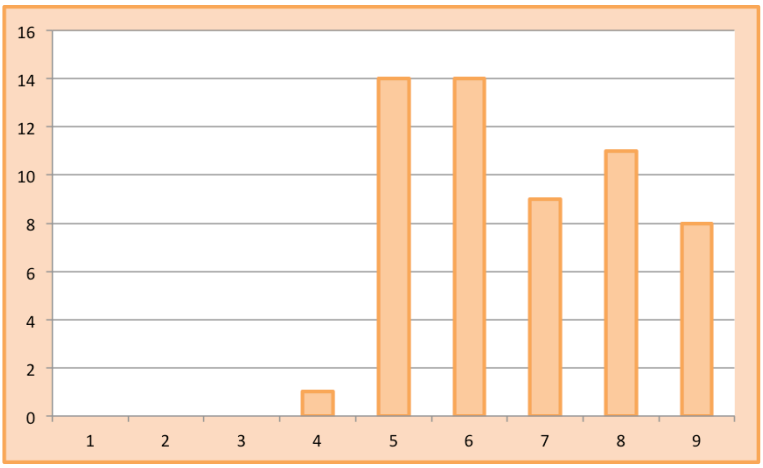

Figure 1 – Survey: Positioning of work
"Where would you position your work on the crossing of ICT&ART when ICT would be 1 and ART would be 9?" (n=57)

Interestingly, when asked about the characterisation of the work *process* as science practice (1) or art practice (9), a similar picture emerges, but unlike pure ICT work, (almost) pure science practice is still selected by some respondents, albeit a small minority.

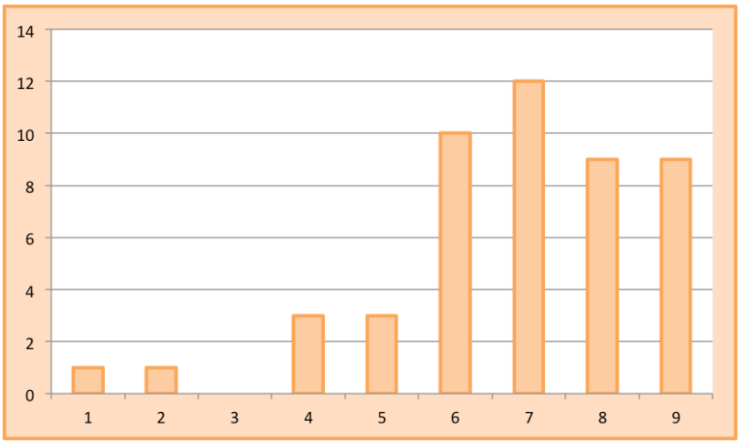

Figure 2 – Survey: Process and practice
"Is your work process closer to science practice or art practice? Where would you position it when science would be 1 and art would be 9?" (n=48)

A **majority of respondents consider themselves as artists** (65%), but 'artist as a researcher' is also popular (53%), and researcher is ticked by 52% of respondents. 'Researcher working as an artist' is selected by 25% of respondents. Other categories (engineer, scientist, ICT'er) score less well than the category

'other', the prominence of which, at 18%, in itself points at a hybrid field hard to capture in categories.

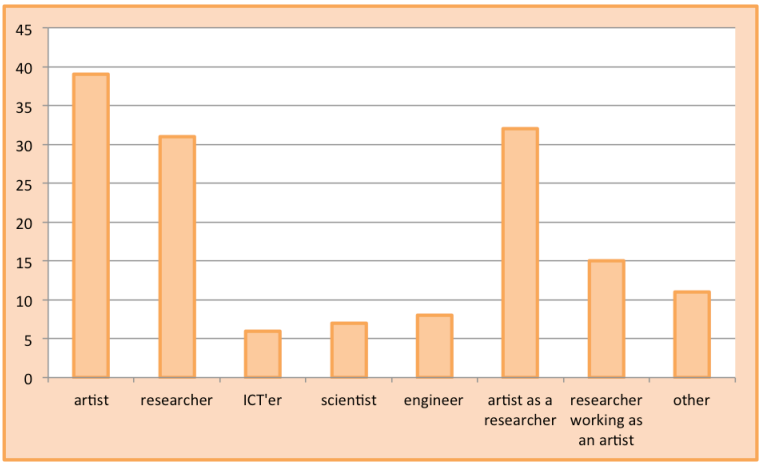

Figure 3 – Survey: Self-description
"Do you consider yourself an…" (Multiple answers possible; n=60)

Freeform open-ended questions about categorisations, activities and concepts form a crucial part of the survey. As such, they again give an indication of the variety and divergences as well as on some common ground. Clustering of the wording used by the respondents to describe their practices and interests (n=95) again reveals the prominence of *art* (including art(s), artist, artistic). The concept is used more than 3 times as often as the second most popular term *media* (including multimedia), 3,5 times as often as *technology* (including technology, technologies, technological). The terms *digital* and *interactive* (including interact(ion)) follow closely behind technology. The figure below represents an approximate visualisation to indicate the relative occurrence of 10 crucial terms used to describe practices and interests.

Figure 4 – Survey: Practices and interests, clustered

We must note that the clustering of terminology must not detract from the complexity and variety of the descriptions received. In fact, while the figure above represents a highly simplified weighted visualisation of some key answers to the survey question asking respondents to describe their practice or interest, the figure below is a more realistic non-clustered overview of the actual wording used in the responses received. The non-clustered nature can for example clearly be seen by the occurrence of the different wordings '*Art*', '*art*' and '*arts*'. It is worth mentioning that domain-specific terms such as for example *music*, *sound*, *animation* and *architecture* also characterise the respondents' practices and

interests, as can be expected, as well as terms such as *people* and *communication*. This figure is not meant to be read in detail, but it provides a snapshot of the complexity of the field captured in the free-form responses.

Figure 5 – Survey: Practices and interests, non-clustered

Again, this demonstrates that a large **variety is an absolutely crucial defining factor** of the field. Clustering exercises similar to the one presented and visualised here can be very relevant for other sections of the survey as well. Nonetheless, the wide variety of responses needs to be taken into account and as the two figures above show, we must ensure that the clustering does not detract from the richness of information that was obtained by means of our open-ended survey approach.

Figure 6 – Survey: Technical skills, non-clustered

When mapping the technical skills (n=47), the prominence of programming is key. Linking this with software, interfacing, coding and processing, it is clear that several of the participants' technical skills relate to coding and programming. As such, even though there is a marked prominence of art in the answer to the question where respondents would position their work between ICT and art (cfr. supra), it is clear that ICT skills are still very much present in a number of respondents' skill set. Finally, words such as audio, animation and electronics elaborate on some of the more specific fields of interest regarding the network's technical competence.

3.1.4. The nature of collaborative and project-based work

Aside from the vast variety deduced from the field's self-description, it is also worth devoting a section to the fact that many stakeholders are used to collaborative and project-based work, as is firstly indicated by the graph below.

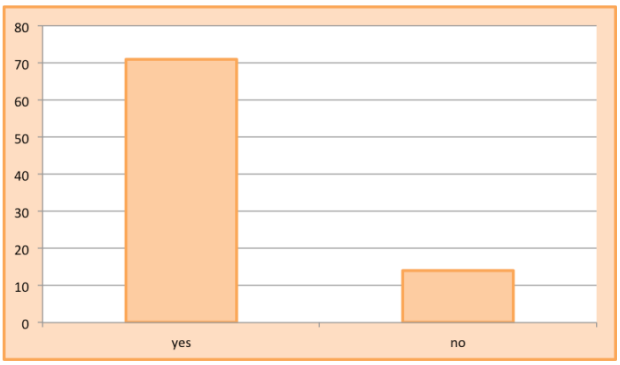

Figure 7 – Survey: cooperation
"Did you ever participate in cooperative projects (in research or arts)?" (n=85)

However, with regards to this study, it is interesting to note that this high incidence of project work does not necessarily translate into an equally high knowledge of funding programmes such as Horizon 2020 or other EU funding programmes such as Creative Europe.

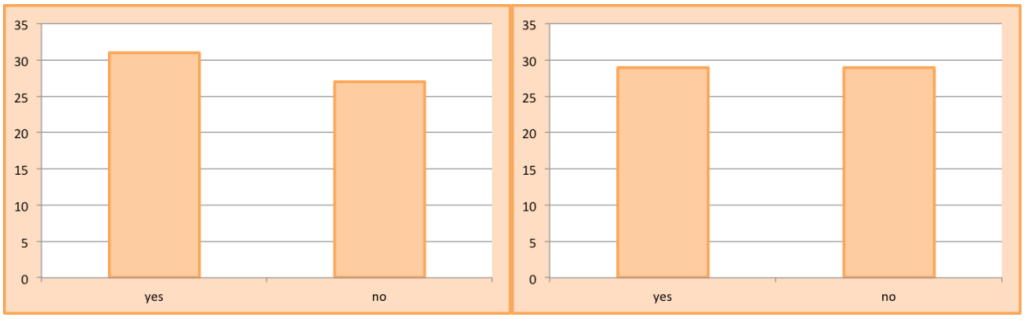

Figure 8 – Survey: European programmes
"Are you acquainted with H2020 (left) or other programmes such as Creative Europe (right)?" (n=58 for each question)

Interestingly, 29 out of 33 respondents ticked "yes" to the question "*If you responded positively to the 2 previous questions, is there a need for a specific line of funding for the sector of ICT&ART in the context of Research and Innovation (H2020)*". These figures are too limited to be generalised in any statistically meaningful manner, but they hint at the fact that those familiar with the H2020

programme may well deem it suitable as a context for a more specific line of funding on ICT and art. However, the respondents also voice certain concerns when it comes to the nature of this collaborative and project-based work and the funding mechanisms suited for the crossroads of ICT and art.

In the next paragraphs, some of the responses to the questions with regards to opinions on successful projects and the reasons behind their success as well as unsuccessful projects and the reasons of their shortcomings will be analysed. The suggestions on specific lines of funding on the crossroads of ICT & art and the current role of the EU with regards to this field will also be discussed. These responses are certainly qualitative in nature and merit a more in-depth treatment. This section intends to **outline concerns and visions that should be taken into account upon formulating recommendations** and can be seen as somewhat of a background check in relation to the chapter on this topic**.** One point of fear or criticism that is mentioned several times is a fear of an **instrumentalist approach to art**. If we quote some of the survey responses, art is, according to these, too often seen as a means towards innovation, '*used as a poor justification of purely scientific projects*', or used '*to generate new commercial products and services'*. In other words – again, taken from the survey: '*Funds are invested in such a frame that economic return is prioritised above other factors of impact. Art and fundamental research share the aspect that their research needs to be developed for the sake of itself (…) Authorities seem to ignore or deny any criticism of the supremacy of the instrumental aspect*'. Some of the answers hint at a dislike for the current creative industries approach from an artistic point of view: '*The EU pays more attention to cultural industries in general than art and art research*'.

These quotes are taken from the responses to the question on vision of the current role of the EU towards the field of ICT&ART (n=40). Responses to other questions echo similar sentiments. The following answers to the question on a specific line of funding for the sector of ICT&ART in the context of EU Research and Innovation e.g. (n=28) are also relevant here: a need for a '*custom designed, hybrid funding program where art & ICT are at the same level*' also refers to the risk of instrumentalist approaches, as does the opinion that artistic research should be part of the calls, as well as several pleas for more direct focuses on artists. As one respondent puts it, there is a perceived need for '*the focus on invention and experimentation without being trapped by the economic outcomes*'. Openness is mentioned several times: open structures, open platforms, more inclusive and more open, and open definitions, i.e. the recommendation to "*keep the definition of 'artist' and 'researcher' as 'open' as possible*".

The answers respondents give on (un)successful projects – in their opinion – as well as the reasons why these can be considered successful or not are also illuminating. **Collaboration can clearly be crucial for failure or success** – good collaboration, cooperation, teamwork, organization and partnerships are named as success factor numerous times. Specifically, respondents also put some focus on the fact that **artists need to be involved in a central role** within these collaboration processes. '*Art practitioners defined the direction and scope in collaboration with others*' and '*possibility of the artists to define the focus*' were listed as a reason of success. Similarly, '*too little communication before and after*', '*one way interaction*', '*not enough team building*', and even both '*too many people*' and '*too little partners*' were listed as reasons for shortcomings in projects deemed unsuccessful. The crucial consortium balance is of course not specific to artistic projects only, it is important in research in general. Nonetheless, the

specificities of art and artistic creation merit a close consideration of feasible collaboration models upon devising strategies to engage more closely with the arts within ICT R&D programmes.

To an extent, some of the survey quotes point out **crucial tensions** that could be present in how to best engage with the field: tensions between being **the need to be cutting-edge versus the risk to be too new**; **being open and flexible versus having well-defined targets**. With regards to the first tension, success factors than have been mentioned include *groundbreaking*, '*innovative approach*', '*experimental and original methodology*', whereas reasons for unsuccessful projects include phrases such as '*too radical and ahead*', '*too early adoption*', '*too soon, too new*'. The second tension has been phrased positively mainly, with success factors listed by different respondents potentially contradicting each other: '*open outcome, (…) no fixed deliverables pressure*' versus '*well planned and managed*' and '*task and goal oriented*'. Being sufficiently open but also sufficiently well-structured is not an easy task. In the strategy to be set out during and after completion of this study, these tensions and fears will need to be taken into account as factors that need to be addressed.

3.2. Mapping the Community: analysis of the map

3.2.1. Methodology

Aside from the survey described in the previous section, this chapter also looks at the map itself. In terms of methodological approach to the online visualisation aspect of our overview of the field under study, it is important to point out that the study platform allows for every organism, individual as well as or collective, to map themselves. This feature allows for an approach that is a mix of bottom-up and top-down, because it is not only based on institutional perspectives or the study team's input, but is also open to public participation.

Our mapping activities aim at creating a notion of the number of organisms active in the field of the crossings of Art and ICT, first and foremost in Europe but also beyond, as well as at characterizing them. We use the term *organism* because it expresses the idea that organizations are composed of real people.[23] It also allows for a broader inclusion of individuals, institutions, companies, non-profit organizations and informal collectives. In the study, the characterization of organisms is done at the following levels: *individuals; organisms; projects; calls.* At the level of the individual, the characterization is made through personal descriptors, working position, related websites, social media links, short biography, picture, affiliations, main geographical location, areas of expertise and participated projects. We have to note the fact that personal information, for legal constraints, can only be added by the concerned individuals themselves. For reasons of privacy and respect for the individual sphere, these personal details submitted by the community are not elaborated on in this chapter. We will focus instead on organisms.

The first task was to come to a consensus about the essential study features that needed to be identified and including in the mapping, taking into account the aims and objectives of the study. This means figuring out what to map and measure

[23] The usage of the term is influenced by the results of the COST Arts and Technology strategic event that happened in Zagreb, in November 2013.

and how best to map and measure it in each case. To achieve this, we have done the following:

- During the kick off meeting in Brussels, we presented the outline and discussed it with all advisory group members present. Comments and suggestions were integrated in a revised version.
- The revised version of this outline was then emailed to the advisory group, asking for their reactions and comments in a second round. Comments and suggestions were integrated in the first preliminary report.
- The pre-final version has been discussed more intensively within the research team, with regards to elaborating further on the research design (collecting data, analyzing and comparing, etc.)
- During the second meeting in Berlin, more outside experts in were brought in to provide input and feedback on the proposed framework for data collection and analysis. This has resulted in an updated research design outline. Based on the information provided in the proposal, the first data inputs were done by team members themselves. This resulted in the first 500 records.
- In a second phase the network itself was invited to participate, in order for the community to enroll itself on the map. This resulted in another 500 up to date records.
- Thirdly, a call was launched for best practice examples in ICT&ART within the framework of presentations and exhibitons at BEAF, the BOZAR Electronic Art Festival. Those who enrolled in this call were automatically also linked to the map.
- Finally a wide set of databases owned and controlled by our partners were manually linked to the map, keeping in mind the privacy settings and the uniformity of data collection.

3.2.2. Data mapping dimensions

An important constraint in the project has been to carry out our studies and investigations in a way that all data could usable within the context and scope of the study, time-wise as well as in terms of the structure of the database and the online platform.

This means not only keeping the data up to date but also linking the information to existing (finishing or pending) projects and maintaining an overview of the relevance of the data. Apart from the efforts done by the research team to gather information, filter and re-structure, the mapping has aimed to grasp the interest of the network itself by means of participation from the community. Thirdly the interactions with partners from the ICTARTCONNECT board and with the network of the research team proved very fruitful. In order to make other databases link with the structure of our map, custom-made software was written and used by the research team, on top of manual adjusting of the data.

3.2.2.1. Generic instructions for the mapping

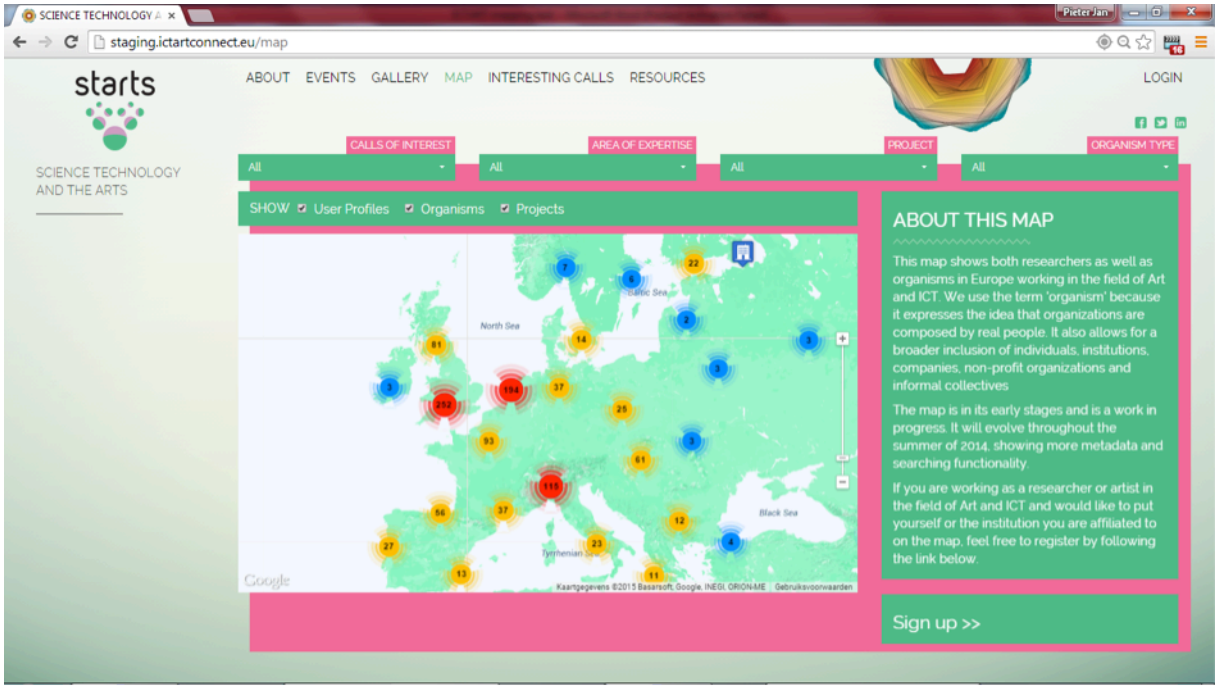

Figure 9 – Platform: overview of the map page

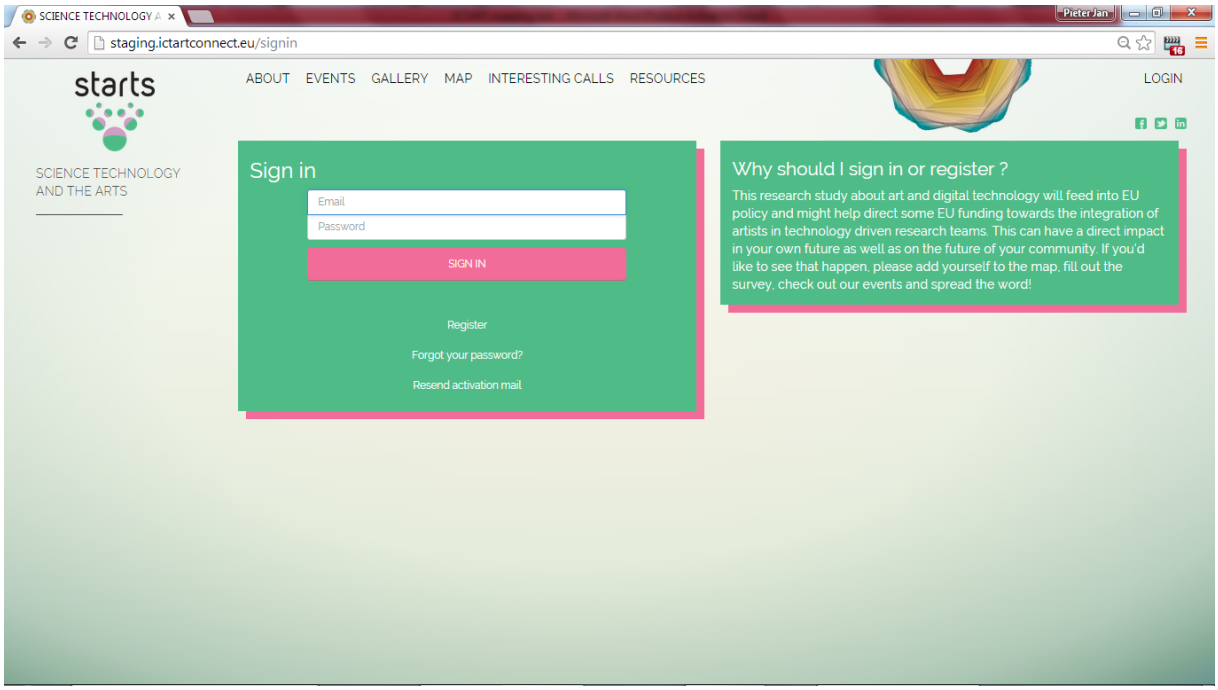

Figure 10 – Platform: sign in or register (part 1)

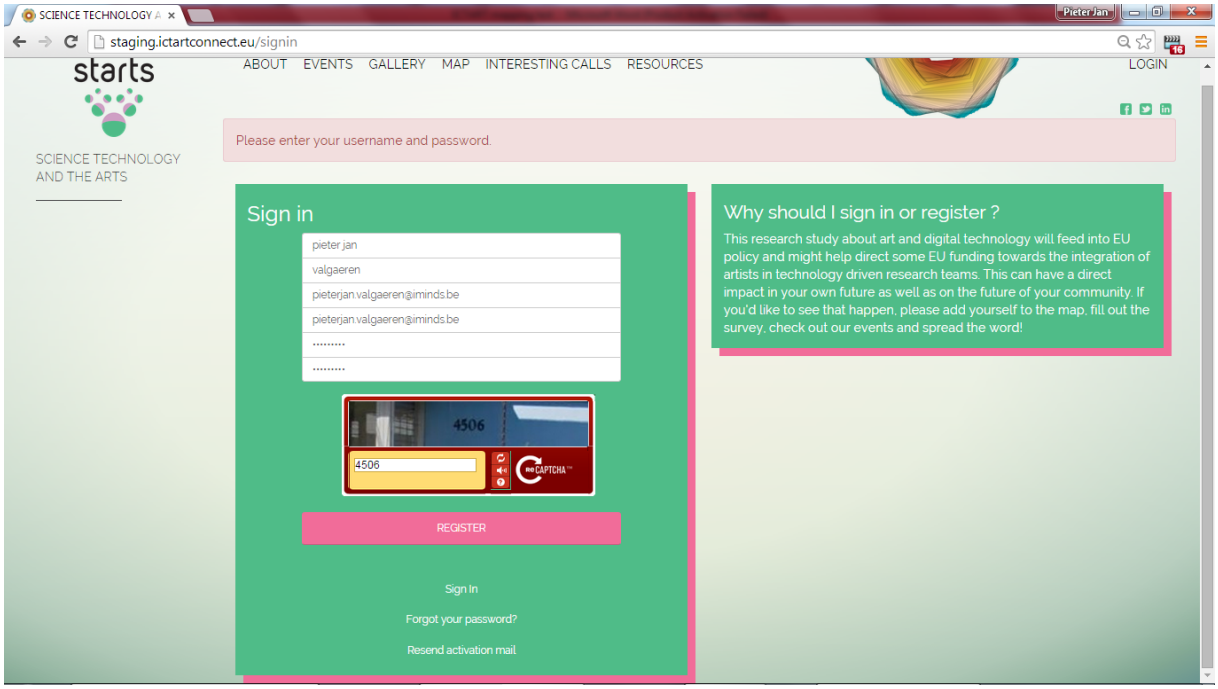

Figure 11 – Platform: sign in or register (part 2)

By signing in on the map a profile was created for every user. This could be person or an organism.

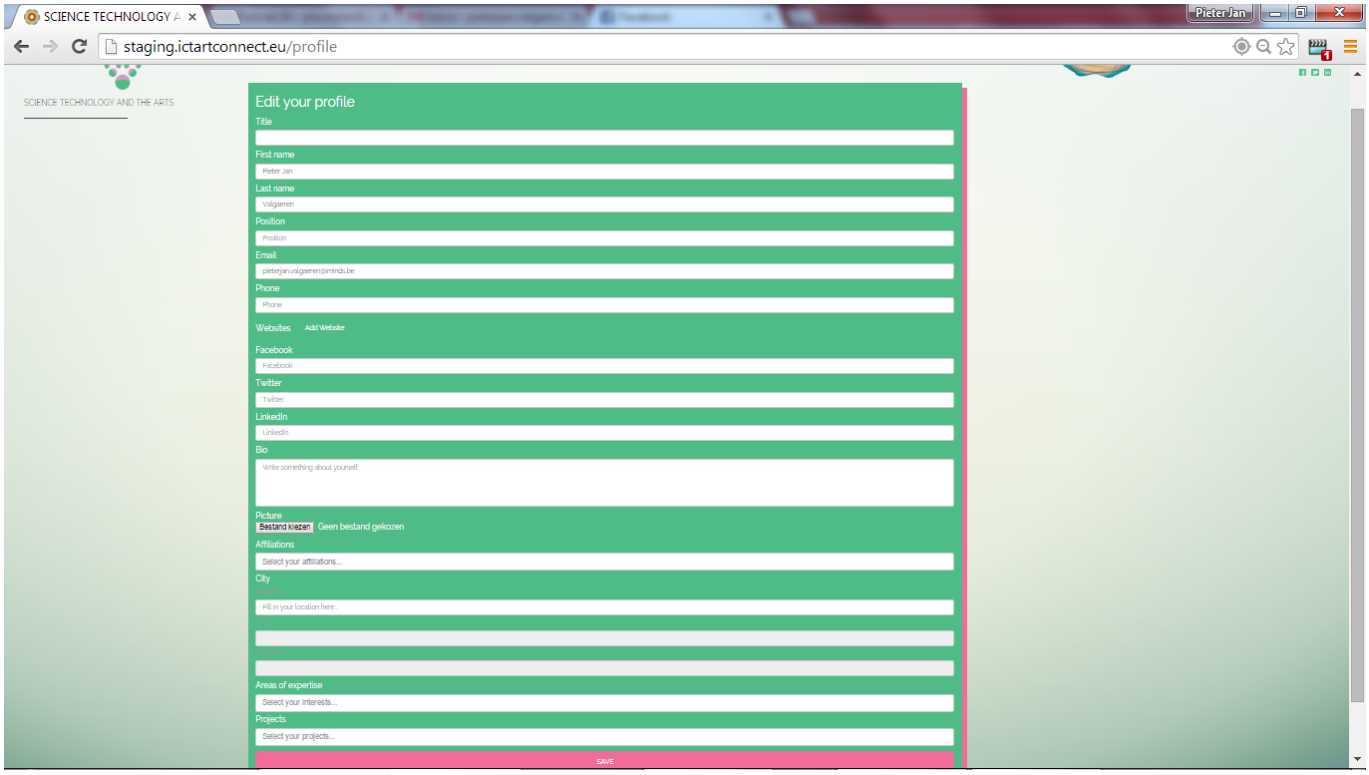

Figure 12 – Platform: profile editing page

3.2.2.2. Mapping personal information

In order to create a profile following information should be provided, though not mandatory, in order to give to users the freedom to register with the information they considered to be important.

- Tittle
- Name (first and last name)
- Position
- Email
- Phone
- Facebook
- Twitter
- LinkedIn
- Bio
- Picture
- Affiliation
- City (address)
- Areas of expertise
- Projects

To generate links between users and to enable the research team to group different users, the last two fields (areas of expertise and projects) are automatically registered and offered to other users to link to when registering. As such, the database structure creates groups of people. The table below gives the example of interests generated by means of this process.

Interests
Virtual reality
Nanotechnology
Geology
Applied math
Medicine
Mobile media
Media Art
Programming
Coding
Immerse technologies
Public Space
Space
Visual programming
3D animation
3D printing
Architecture
Music
Fundamental research

Cross-disciplinary research
Art & Science
Interactive Art
Metadata
Art theory
Art history
History
Photography
Interaction design
Behaviour design
Language/Semiotics
Futurology
Ecology
Economics
Sound
Curating
Live media
Street Art

3.2.2.3. Mapping Projects

During the analyses of the field, a number of projects were selected to include in the database. They started as a pop-up list for new users to be able to select projects which they have worked on. During the runtime of the study, the users expanded this field to a total of 96 different projects.

As the field was not mandatory and open to fill in, a very diverse set of projects were presented. The majority of the projects can be linked to EU calls, but other project types such as co-productions, incubators, US university projects or magazines were also enrolled in the project field. This once again confirms the diverse nature of the field, but it also makes it difficult to derive meaningful subsets or groups from the input that was given in this database field.

3.2.3. Analytical dimensions

3.2.3.1. Cultural and historical aspects of organisms

During the study interesting debates and discussions were held on the structuring of the organizations in the field of ICT&ART. By harvesting data and by mapping the field, the vast amount of different structures became clear. Therefore an open field of 'organisms' was created in the mapping. As such, the possibility was created for the users enrolling themselves on the map to 'define' the organization field. Before going further into redefining the 'organism' category and going deeper into the data, we first give an overview of some of the reasons of this diversity.

a) Administrative traditions

The map is structuring all sort of 'common practices', dealing with all sorts of organisms of all sizes, that differ not only in the way they are structured also in their administrative denominations. For example projects resulting in cooperative structures dealing with external funding often have different administrative traditions in the US or in the EU, with different financial structures or liabilities.

b) Government/societal culture

Next to research or academic related cooperative structures, numerous organisms are linked and structured based on the specific governmental or societal culture that surrounds them. Firstly, a lot of the bottom up or grassroots communities are related to specific regional or national developments surrounding the context in which they emerged, whether this links to political, social or governmental situations. The experimental projects that were set up in eastern Europe after the unstable political situations in the '90s, such as by .net art pioneer Vuc Cosik in Slovenia are a good example. Secondly, academic related organisms as well as community projects are often structured based on the relevant government' policy priorities. Some fine examples can be found in Northern Europe, where universities are working cross-disciplinary, as for example AALTO University.

c) Dynamics of the field

As already discussed in the historical chapter of this study, the field of ICT&ART has been vividly changing in the last decades. Next to the reasons cited above, the field itself has been constantly changing due to its own dynamics and specific nature.

3.2.3.2. Legal/constitutional aspects of organisms

a) Statutory basis:

Dating back to different contexts and histories, the statutes of organisms tend to differ regionally and locally. Depending on local legislation, there tend to be differences in for example the foundation structures. Common law foundations have different legal identities, structures and legal liabilities than European continental foundations, as for example the often-used French 'fondation', which is popular for a lot of artistic group practices. Thus we see this often being used for organisms with a strong future perspective in maintaining artistic practices and visions of one artist or a group.

When filtering deeper into the constitutional aspects of the organisms at stake, there is a tendency of organisms that grow without a specific future perspective or approach and those who are founded and constituted with a specific angle on planning and future impact With other words those that just start up and grow according naturally and those that are founded with statutes and perspectives. The time and goal factor in the constitutional aspect is, linked with the legal aspect, is as such of great importance.

b) Social responsibility and operational structures:

A parallel perspective can be seen when looking into the social responsibilities and ope rational structures of the organisms. Especially when dealing with the more community-linked organisms and projects, the context of DIY and social inclusion tends to blend these organisms with the (local) network at stake. FAB-labs or project spaces, providing the network with a working space and community, are structured and often restructured according to these principles of social responsibility.

3.2.3.3. The relations between organisms and users

a) Linking organisms and users

The majority of organisms on the current ICTART connect map are linked to (end-)users by some form of interaction, meaning that all the users on the map can be linked to one or more organisms. Linking the project stories from the ICT&ART Connect call (of which a selection was presented at BEAF 2014), the successful stories mapped during the study, the interactive discussions and interviews with each other gives an idea of the networked nature of the environment in which the users operate. Mapping these organisms, its becomes clear that individual users can be linked to organisms based on projects that they were in, funding lines for which they applied or project spaces in which they worked or exhibited their work. Given the high amount of academics in this field, the affiliation with universities and research centers are of great importance.

b) Education:

As stated before, the majority of the users have an academic background, and many have a PhD or are in the process of obtaining one. Though a small group of these academics link themselves to one university or research center, the majority has links with more than one. Not only do these people have an extensive background in training in academic and university terms, but through interviews and talks it is also clear that transferring knowledge and skills remains highly on the agenda. Many of these profiles hence become professor or teacher in a traditional academic contexts, but some also facilitate new views and visions on research, as for example Roy Ascott and the Planetary Collegium.

3.2.3.4. Role of the private sector

a) Role of societal/non-profit organizations

In an emerging field with specific societal impact the role and importance of non-profit organizations is clear. As stated in the historical background of ICT&ART, the legacy of the field is structured around bottom-up processes dealing with ad hoc inspirations, scientific opportunities and the will to create a more diverse scope versus art and technology. Therefore a lot of non-profit and societal organizations were created to cluster views of like-minded people. Whether small or medium size, long or short-lived, these organizations were or are the backbone of a lot of development, research, production or presentation of ICT&ART projects. They provide a network, production methodologies and methods, technical equipment and physical and conceptual spaces to rethink the boundaries of ICT&ART.

b) Role of profit-oriented organizations

The profit sector has always had a slightly ambiguous role in ICT&ART development. In the past it has been supportive from the moment tangible and marketable projects and products came out of (private or public) supported research. The sector was supportive on the sidelines but, with a few exceptions, it wasn't until the last 15 years that it sometimes became the driver for crossovers between the field of ICT&ART. Some projects, for example linked to presentations such as the Phillips pavilions at different world exhibitions, have given artist platforms to totally think outside the box for R&D. Experiments of bringing artist in research groups emerged, not only for their creative input but also for their disruptive input. Being able to look at the reality, the purposes and the possibilities of available technologies, they were able to create a cross-over while just being themselves in a R&D or R&I environment. The impact of these collaborations within for example Yahama or Sony, mostly tech related

companies, has stimulated the broader industry towards collaborations with in-house artist, like for example Mercedes-Benz.

During interviews, conferences and discussion moments with the advisory group of this study, the 'independence' or 'artistic freedom' aspect of these programs was often discussed. From one side, artists tend to be rather critical about the collaborations, due to bad experiences of 'instrumentalisation'.[24] This can be experienced as being used because of their knowledge or background, with a clear revenue perspective for the corporate actors, or without a concrete network to operate in, and it can create a rather negative aura around these experiments. Also, predefined, narrow or focused project or product scopes did not always give artists the opportunities they saw or wanted within this environment. Often this is linked with the inability of certain technical or research profiles to work 'on a blank canvas' or 'totally outside the box'. Currently, these collaborations are often better structured, with a more open and precise task for the researcher-artist to work on. A more open approach towards non-productive methods, discourse setting and the rethinking of production processes has given these collaborations more mental freedom.

3.2.4. Mapping the field through organisms types

3.2.4.1. Former mapping initiatives: Digital Social Innovation project

As stated in the beginning of this chapter the vivid discussions around mapping, structuring and displaying the emerging field of ICT&ART resulted in more in-depth research towards existing mapping tools and methods of interesting EU funded projects. Being able to work further with existing mapping tools has given us access to a broader toolset and the opportunity to have future links to projects in and around DG Connect. For this purpose the research team decided to adapt the same structure as the Digital Social Innovation project (2014). [25] [26] This project aims to map and describe a much broader field of digitally and socially driven innovation hubs in Europe. Crosschecking data and methods, it became clear that the characterization used by DSI matched closely to our discussion on filtering and displaying the ICT&ART field. After customizing the adapted structure towards the field of ICT&ART, the filtering has resulted in the following table.

Type of organisations	Working method towards digital and social innovation
Government and public sector organisations	Providing funding for R&D and R&I Providing non-financial resources (i.e open data) Delivering or partnering for networking
SMEs and large businesses	Delivering services (i.e. consultancy, art creation, support,…) Providing funding for experiments, R&D and R&I In-house artists Providing non-financial resources (i.e. facilitating research or co-creation)

[24] Jan Jagodzinski,Jason Wallin, 'Art Based Research: A critique and a proposal', Sense Publishers/ Springer Science, 2013.
[25] Lesley Duxbury, Elizabeth Grierson and Dianne Waite, " Thinking Through Practice: Art as Research in the Academy, RMIT Publishing, 2008.
[26] http://content.digitalsocial.eu/wp-content/uploads/2014/05/DSI-report_final_19.05.2014.pdf

Academia and research institutions	Analysing trends and movements Providing new (fundamental) technologies and methodologies Dissemination of ICT&ART projects and ideas Providing technical support for (co-creation) Pitching and funding opportunities within project scopes
Grassroots movements	Engaging, facilitating and expanding communities Democratizing access to emerging technologies
Social enterprise or foundation	Delivering services (social or charitable) Often community-based Often of an artistic nature

3.2.4.2. Re-mapping the ICT&ART database

Based on this table, the ICT&ART records needed to be adapted and re-filtered. Intensive desk research resulted in 1234 records that were filtered and updated in the database. Next to the not pre-programmed field of organism, the dropdown table of four organisms type was now applied on every record. The references were checked and all entries were provided with an up to date email address to be able to keep the platform alive, up to date and transposable into other or newer initiatives. With the perspective of inputting other existing databases, this structure will be maintained in order to map and group the organisms based on their structure and background.

3.2.4.3. Clustering organisms

With the methods used a clearer overview can be given of the amount and types of organisms mapped in the field of ICT&ART. Again, we must state that this is a snapshot of the network after one year of mapping, and the methodology as such does not enable statistically representative quantifiable results. Also, it is important to add that the database and platform are built to be dynamic and to accommodate further growth even after completion of the project. The figures and screenshots below hence capture a moment in time that corresponds with the writing of this final study report, but may well grow in the future.

Types of organisms	
Academia and Research	223
Business	348
Government and Public Sector	94
Grass Roots Organization or Community Networks	330
Social Enterprise or Foundation	239
TOTAL	1234

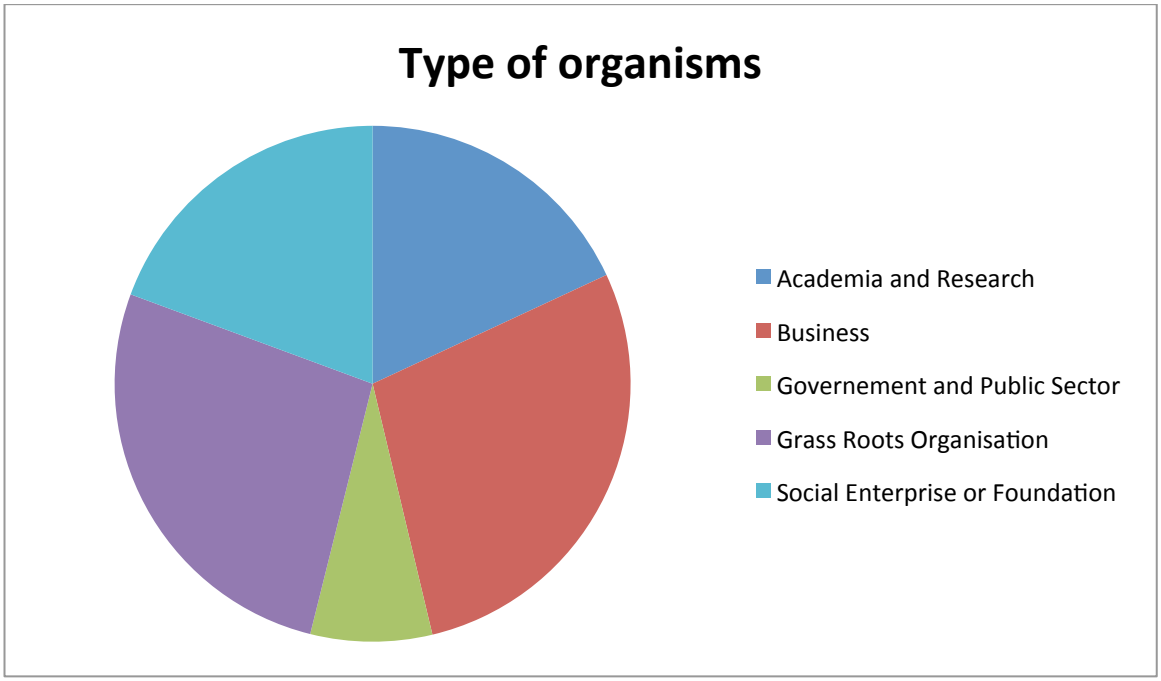

Figure 13 – Mapping the organisms in the database

These numbers give some interesting insights in the network of ICT&ART.

1. Business related services are well represented in the sector. This means that a large amount of professionals are able to create products or to deliver services in this area.
2. As expected based on the primary mapping of the users, there is a vast amount of academia related organisms present. These are not only traditional academic structures but can also be research centers that are partially funded by the private sector.
3. The bottom up qualities of the field can be supported by the high amount of grassroots organizations and foundations (330 and 239) that take over a substantial part of the field (46%).

The government and public sector is in this graph the smallest marker, though it needs to be said that many projects and project budgets within the other organism types can also originate from government initiatives and financing channels.

3.2.4.4. Regional spread of organisms

a) Academia and research institutes

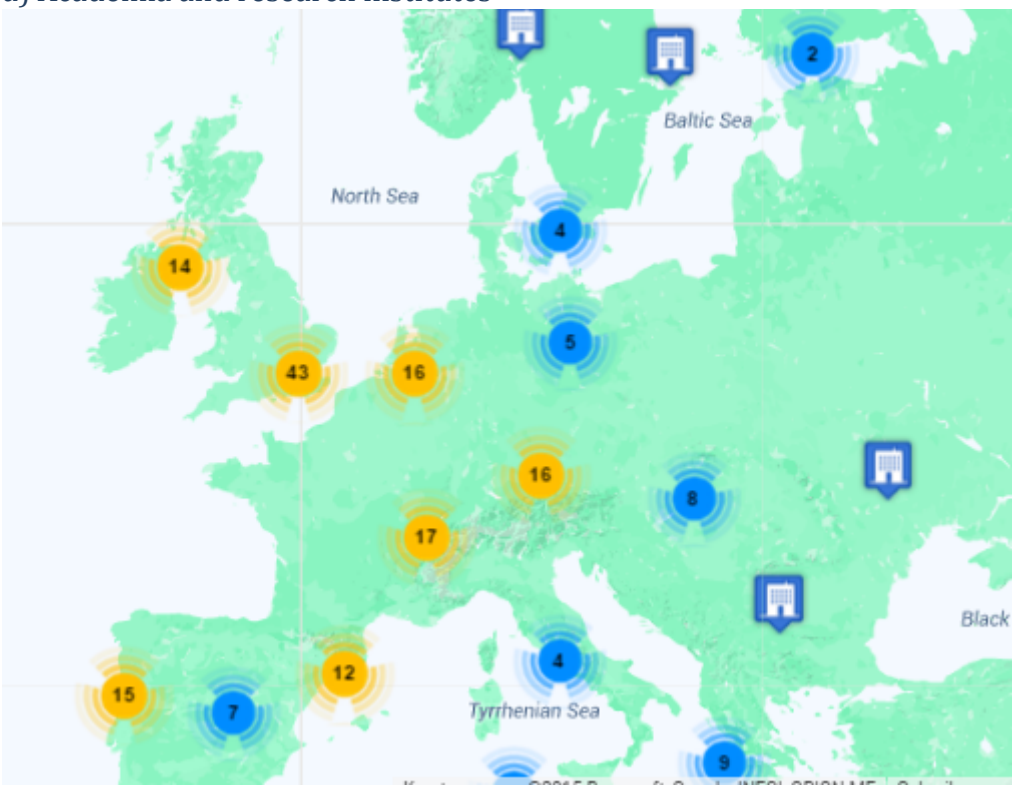

Figure 14 – Map view, academia / research

Looking at academia and research institutes, the spread within Europe illustrates an interesting approach towards R&D, though we must again stress that these findings have to be considered as indicative rather than statistically relevant. One major poles is clearly marked, namely the London area. In this area there is a high and balanced performance across activities in ICT, R&D, R&I and business. The crosslinking of disciplines makes London as well as Munich poles of ICT innovations, as was already stated in the EIPE project (European Poles of Excellence).[27] However, the prominence of Munich, even though it is well know for its high density of activities, is less clear on this map, and the area certainly doesn't come across as strongly as London: several other strong areas can be discerned on a similar scale to Munich. Also the South of Europe is well presented with a wide set of academic organisms in Portugal and the North East of Spain.

[27] http://is.jrc.ec.europa.eu/pages/ISG/EIPE.html

b) SME's and large business

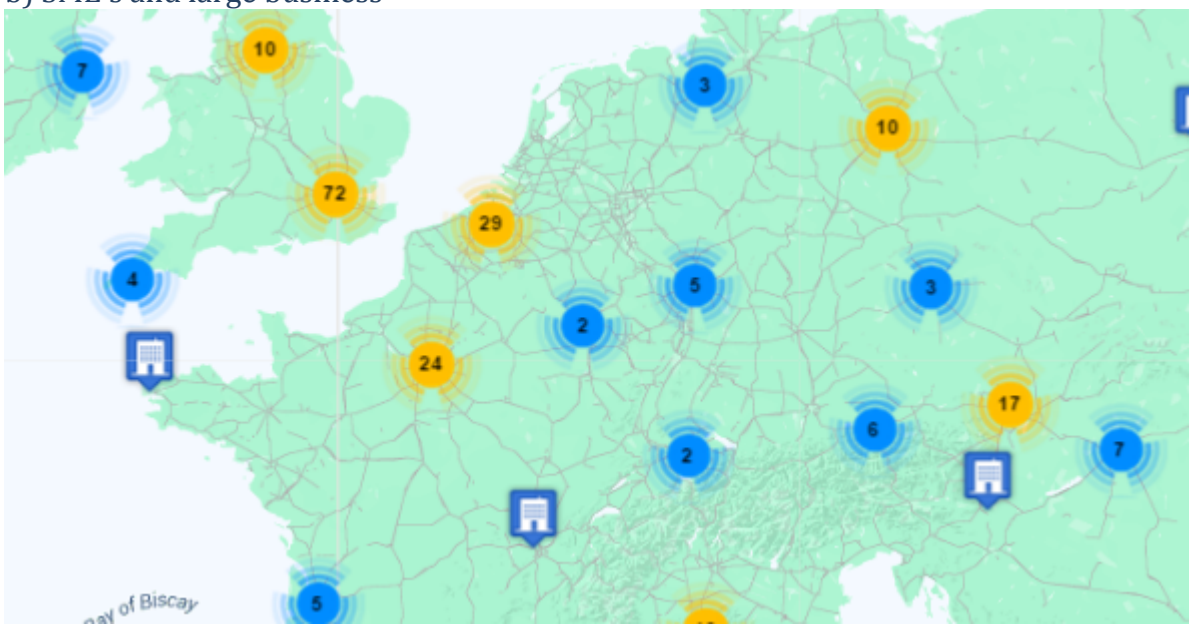

Figure 15 – Map view, business

A slightly different view can be seen when filtering on business. A clear marker can again be placed in the London area, around where 72 business entities are linked to ICT&ART. Germany is less prominent when the map is filtered on 'business' as the organism type, but instead Paris is heavily marked as business pole for ICT&ART entrepreneurs. Vienna also clearly stands out, which can be linked to the innovative discourse mechanisms that Austria, with i.e. Ars Electronica in Linz, has been presenting since the last decade.

c) Government and Public Sector

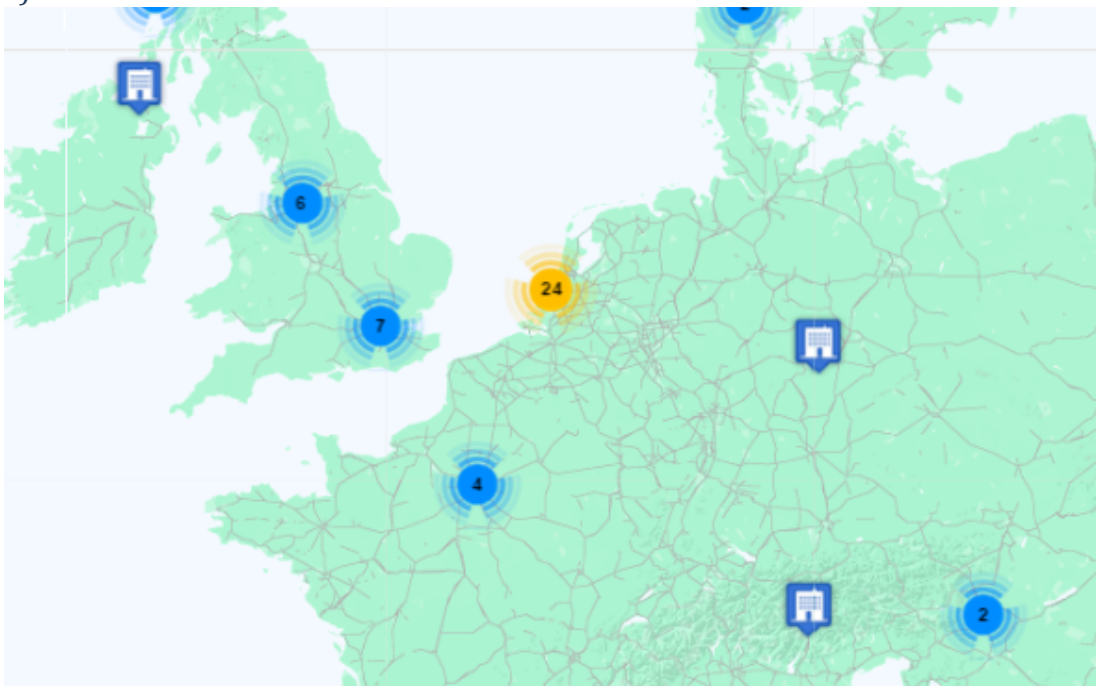

Figure 16 – Map view, government / public sector

When looking more closely on the map, one finds a high concentration of institutional organisms in northern Europe. The Netherlands have a high concentration of digital related platforms in The Hague, such as DEN (Digital Heritage Netherlands) but also Europeana. More to the east, the region of Eindhoven has over the years been working on an innovative strategy towards ICT, as it is the hometown of Phillips. Logically Brussels also stands out with European related institutions and different digital orientated platforms. This is, however, less visible at the zoom level presented above, as the cluster in the Netherlands also comprises these Brussels organisms. The following figure therefore illustrates this area in more detail.

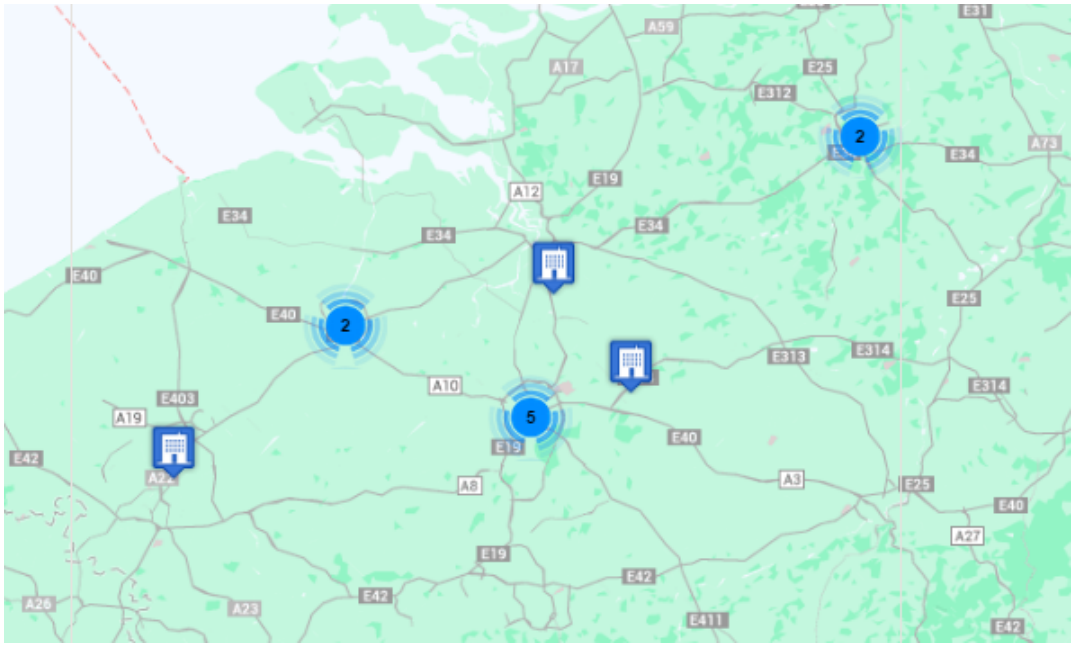

Figure 17 – Map view, government / public sector, zoom level

d) Social Enterprises or foundations

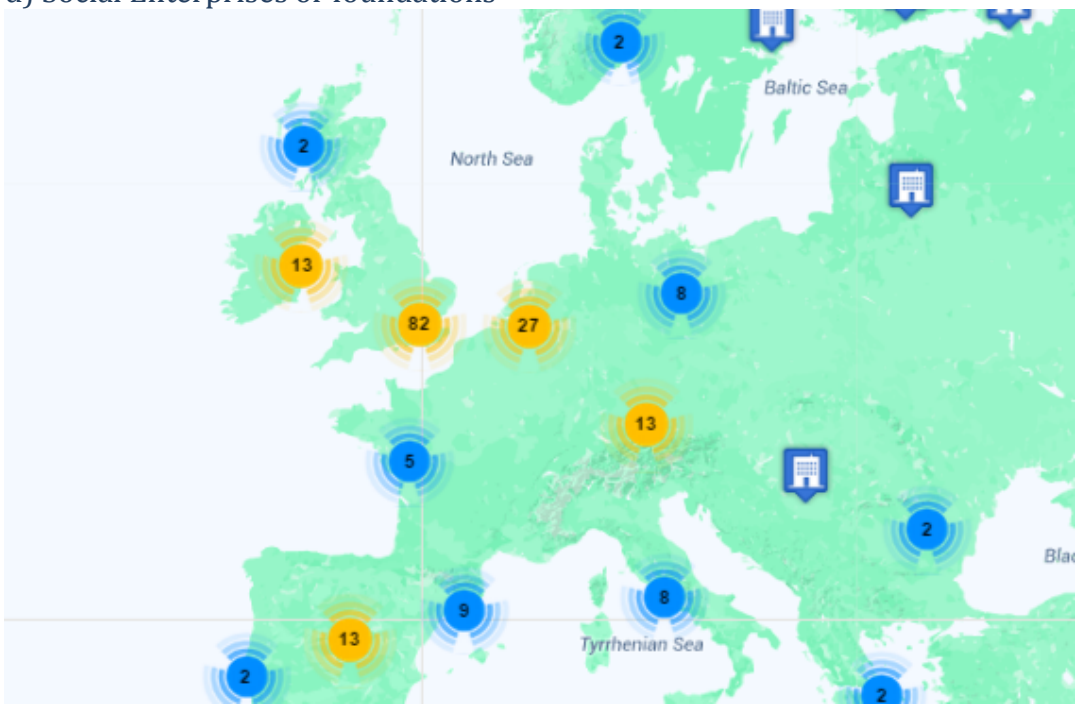

Figure 18 – Map view, social enterprises / foundations

A wide spread of foundations and social enterprises or charities can be found all over Europe. A high concentration can be found in the UK, which can be linked to the popular and practical approach towards foundations in Common Law[28], but also to a long tradition of foundations within the arts in the UK. A similar view and reasoning can be applied to the high numbers on the map in the Netherlands. Vienna as a hub for these organisms is once again linked to the programming of Ars Electronica and the supportive approach of the government towards ICT&ART.

e) Grassroots organizations or community networks

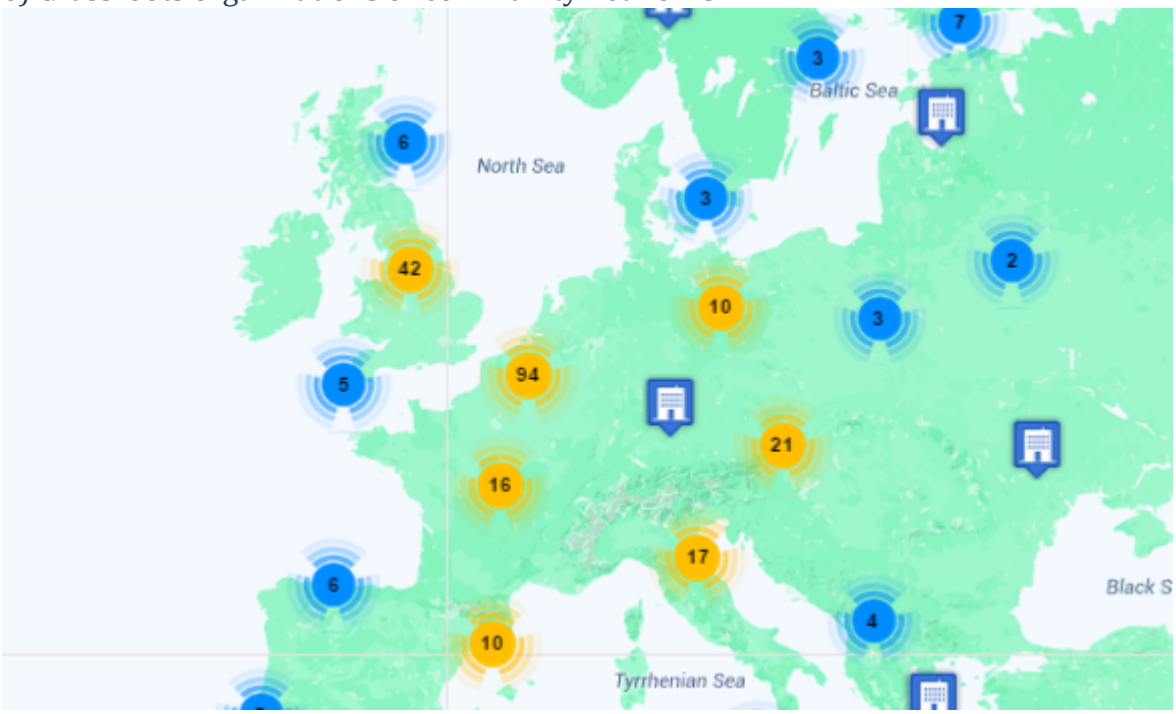

Figure 19 – Map view, grassroots / community

An interesting spread can be found in the grassroots organizations. A high concentration can be found in central Europe, with high clustering in Paris (24) and in Brussels (14), as the screenshot below illustrates in more detail.

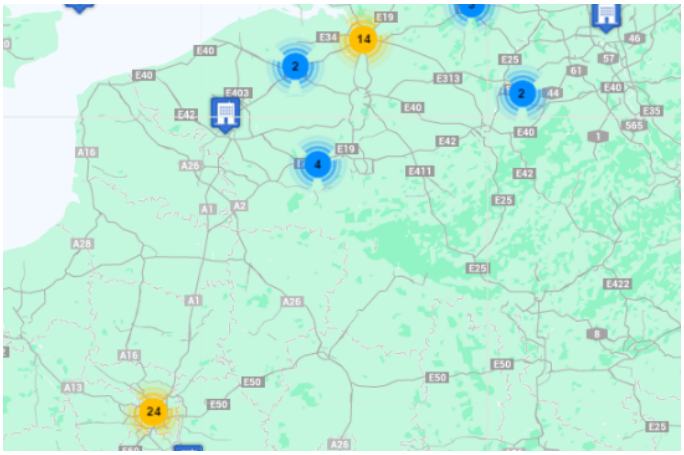

Figure 20 – Map view, grassroots / community, zoom level

[28] For more details, see 3.2.3.2, on statutory basis

Considering their background in the arts in general, and the traditions of small scale supportive initiatives of the artistic sector itself, these capitals host an interesting group of these types of organisms. The same is true for London: a large group can be found in the UK (53), of which the majority are based in London, but a geographical spread can nonetheless be discerned. Other concentrations worth mentioning can be found in Austria (21) and in Northern Italy. Overall there seems to be a very strong and vivid self-maintaining and bottom-up movement in ICT&ART in Europe. This will also emerge from the following chapter, where successful project stories are analysed.

4. SUCCESSFUL PROJECT STORIES ANALYSED

4.1. Introduction

During the course of the research and following instructions of the advisory group it was decided not to have a best practices approach as part of the study. Instead, the notion of successful project stories was adopted. The idea of best practices implies a matured coherence in the field of activity that is not adequate to the emergent aspect of the field being characterised. On the other hand, classifying a practice as one of the best in its field tends to generate exclusion through excellence. Being inclusion one of the most important priorities in general in European affairs, and specially when it concerns with matters of the digital, it would be contradictory to follow a path of exclusion. Furthermore, plurality and diversity of the observed activities would not be properly reflected in an analysis based on a principle of unification of practices.

Therefore, the notion of successful project stories was adopted based on the assumption that every successful activity started as a project. The understanding of success factors of such projects is extremely important in order to better create the appropriate support policies for the emerging field of practice being studied. Looking at a project as a story emphasises the human aspect of practices that are better described through keywords such as sensitivity, subjectivity and creativity.

Stories to look at were selected randomly within a group of cases known to be commonly accepted as references. They were presented to the advisory group that complemented the list of cases and approved it. A total of 52 cases were selected as being fully representative of all potential sectors of the emerging field resulting from the crossings of arts and ICT. The full list of the cases analysed can be found in Annex II. The majority of the selected stories have a recent history. The emerging field is relatively new and therefore more consistent and numerous manifestations can be found in the recent history. The historical summary presented before in this report allows for a contextualisation of the origins of the cases described.

4.2. Method

The method of analysis of the successful project stories is in itself an example of integration of artistic practices in research activities. The building of the graphics was done by a computer program specifically made for the purpose. The algorithm was written in one of the software development platforms analysed as a successful story itself, *Processing*.

The method allows both for the quantification of subjective information and for an approximation process to define both a taxonomy and a vocabulary to characterise the emerging field in analysis, that is known to be wide and diverse.

The core process of the analysis was the visual association of answers to questions asked to each one of the cases analysed. Answers were grouped by similarity. This process led to the emergence of general classifications. The taxonomic approach was a direct result of the analysis of cases in focus, therefore avoiding the potential narrowing and pre-conceptualisation of view implied in pre-determined classifications.

The process resulted in the composition of a specific graphic for each one of the 10 questions asked to each of the 52 stories. The observations of the graphics gave origin to the written descriptions associated to each one of them. Only the more relevant graphics are presented in the report. The questions asked are the following:

"*What is it about?*";
"*Why is it a success?*";
"*What came out of it?*";
"*Why did they do it?*";
"*What was the environment?*";
"*How were they organised?*";
"*What was the background of people involved?*";
"*How many were they?*";
"*When did it start?*"
"*Where were they?*"

As referred above, the grouping of answers originated the classes to be applied in the analysis. Many of the cases fit in different classes in the same object of analysis. The same organism exercises different and complementary activities simultaneously. Therefore, reclassification tables were made for selected questions where such principle of diversification better applies: "*What is it about?*" and "*What came out of it?*".

Furthermore, comparative analysis at the intersection of questions asked was also performed. For example, understanding types of activities chronologically. The following comparative question analysis were made:

"What is it about? - When did it start?"
"Why is it a success? - How many were they?"
"Why is it a success? - What was the background of people involved?"
"Why is it a success? - What was the environment?"
"What came out of it? - When did it start?"
"Why did they do it? - When did it start?"
"What was the environment? - When did it start?"
"How were they organised? - When did it start?"
"What was the background of people involved? - What came out of it?"
"Where were they? - When did it start?"
"Where were they? - What is it about?"
"Where were they? - How many were they?"

All the information was accessed on the Internet at pages described in Annex II. Therefore it can be seen as a self-portrait from the community. For reasons of data processing some of the extracted quotes where shortened and summarised in its graphic version.

4.3. Analysis

Classes were extracted as result of the analysis of the graphics composed. They are presented by question and in a decreasing order of relevance. The name of the classes was attributed in order to better characterise in general the answers included in each group.

"What is it about?"

Figure 21 – Stories: What is it about?

Looking at the main areas of activities of the organisms analysed we observed that 3 main groups of almost equal relevance emerged:

RESEARCH: Activities focus mostly on research related to new uses of ICT. Hands-on approach and practical experimentation are common ground. Nonetheless, development of new theories then tested in practice is also a relevant aspect of practice. The research of Manfred Clynes is a good example of the latter and it is even symbolic of the potential contributions of the arts to ICT: the development of algorithms to quantify emotional expression. The concept of media lab, laboratories normally associated with the development of new media towards society, are common in the field. The engagement with society is clear. As an example, the description of Medialab Prado includes the notion of "*citizen laboratory for experimentation on digital networks"*.

PROMOTION AND SUPPORT: An almost equal percentage dedicates itself to presenting works, mostly looking at participation of the public. This category also includes specific funding programmes, digital online content distribution platforms and network-based activities. The crossing with the Cultural and Creative Industries is included in this class and it mostly relates to physical infrastructures for the practice of digitally based arts.

DEVELOPMENT: This group is of extreme importance because it is about artists producing new technological developments and making them available to other artists and creative practitioners. Theses new technologies and applications result from research done for the developers' own practice, but in the context of open software and hardware communities. Sharing knowledge for creative purposes is common practice and it led to the creation of self-sustainable platforms for software and hardware development. Some of them such as *Arduino* expanded into other fields of practice as popular platforms for prototyping. Some of these

developments have had historical impact in technological progress. The development of the first digital music synthesizer, the DX7, by John Chowning led to great advancements in digital sound synthesis and digital signal processing in general.

PRODUCTION: A significant number of organisms is dedicated to the materialisation of art work, design and other technical applications. This is a very important aspect of the practices of art: concrete outcomes. In some cases, especially in a field designated as *design thinking* solutions are conceived responding to specific problems. Here, aspects of hybridity of competences of individuals practicing in the field become relevant. As described by somebody in one of the roundtables organised in the context of this study, the same individual can simultaneously respond to a challenge as an artist, by refining a problem, as well as a designer, by proposing a solution to the problem.

LEARNING: A growing percentage of actors in the field is developing new forms of learning both at masters and PhD levels. The number of masters and PhD's in the field is growing exponentially. Some models are even being exported from the EU to other parts of the world such as China. The active population of the emerging field of arts and ICT is highly qualified.

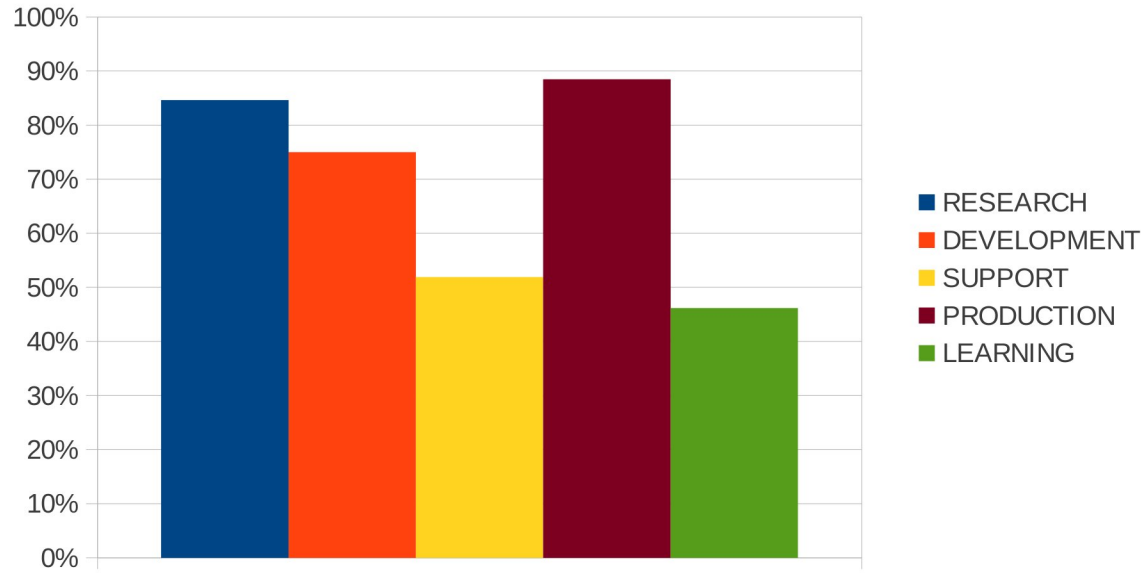

Figure 22 – Stories: What is it about? Activities regrouped

The previous figure 30, which is the result from the Processing algorithm, grouped the cases exhaustively in the categories resulting from this algorithm. However, this does not mean cases grouped in one category cannot be involved in activities described by the other categories. A further analysis of the project stories, making use of the categories that have emerged from the Processing, reveals that, in fact, 88% of the cases was involved in production activities; 85% in research activities; 75% in development of new technologies or applications; 52% conducts support activities and 46% was involved in formal and informal learning activities.

"Why is it a success?"

Figure 23 – Stories: Why is it a success?

Success factors observed resulted in 7 distinct groups:

PRODUCTS and SERVICES: the majority of the cases became very successful products and services, normally starting from an artistic need and spreading as commercial success in other fields of practices in ICT. These cases are extremely relevant because they demonstrate the sustainability of concrete outcomes of engaging with the arts in ICT in the crossing of research, design and industry.

INTERNATIONAL: in a considerable number of cases the success factor is related with the establishment of international references in the field. Promoting international gatherings of experts in remote locations to become an international reference is a common strategy.

NEW CONCEPTS: totally new ideas in the form of processes and concepts turned some cases into recognised models of practice. They are breakthroughs in the conception of technologies or of their application or dissemination. Sometimes they result from critical approaches to the established views, while some others are simply the outcome of radically new ways of thinking.

POTENTIAL INNOVATION: outstanding previously unforeseeable inspiring applications of ICT are the fourth relevant success factor. Contrary to the previous factor these innovations remain potential, i.e. they did not reach market maturity.

COMMUNITY: the creation of significant communities of creative developers or researchers is an indicator of success. The recognition amongst a community is a very important stimulating factor in these practices of art in ICT.

SUPPORT: in this group of cases, the main factor of success is the number of other successful projects that they promoted. The model of an organism

supporting activities in the field is fundamental, due to the small scale of the majority of these projects. Such organisms allow for the reduction of bureaucratic and administrative dimensions at the creativity level.

POPULARITY: some of the cases became global scale phenomena due to the number of users adopting them. They are mostly platforms for distribution or standards platforms for development.

"What came out of it?"

Figure 24 – Stories: What came out of it?

The outcomes of the successful projects analysed are very diverse in genre as well as in different results produced by a single organism. Nonetheless, 5 groups of results can be typified:

EXHIBITIONS: the majority of the outcomes are made publicly available in the form of exhibitions. Experiential and interactivity are keywords in the realisation of activities. Participation and citizen engagement are also becoming very popular. This class includes interactive artworks.

PRODUCTS AND SERVICES: a significant number of cases results in new products and services.

RESEARCH: activities related with research are also popular including workshops, publications, conferences and prototypes.

DEVELOPMENT: a considerable number of new development platforms has recently emerged from the observed activities in the field.

EDUCATION: the number or graduates in disciplines associated with the crossings of ICT and the arts is growing. However, multidisciplinary, interdisciplinary and transdisciplinary approaches to knowledge generation are the most popular and significant in the field.

"Why did they do it?"

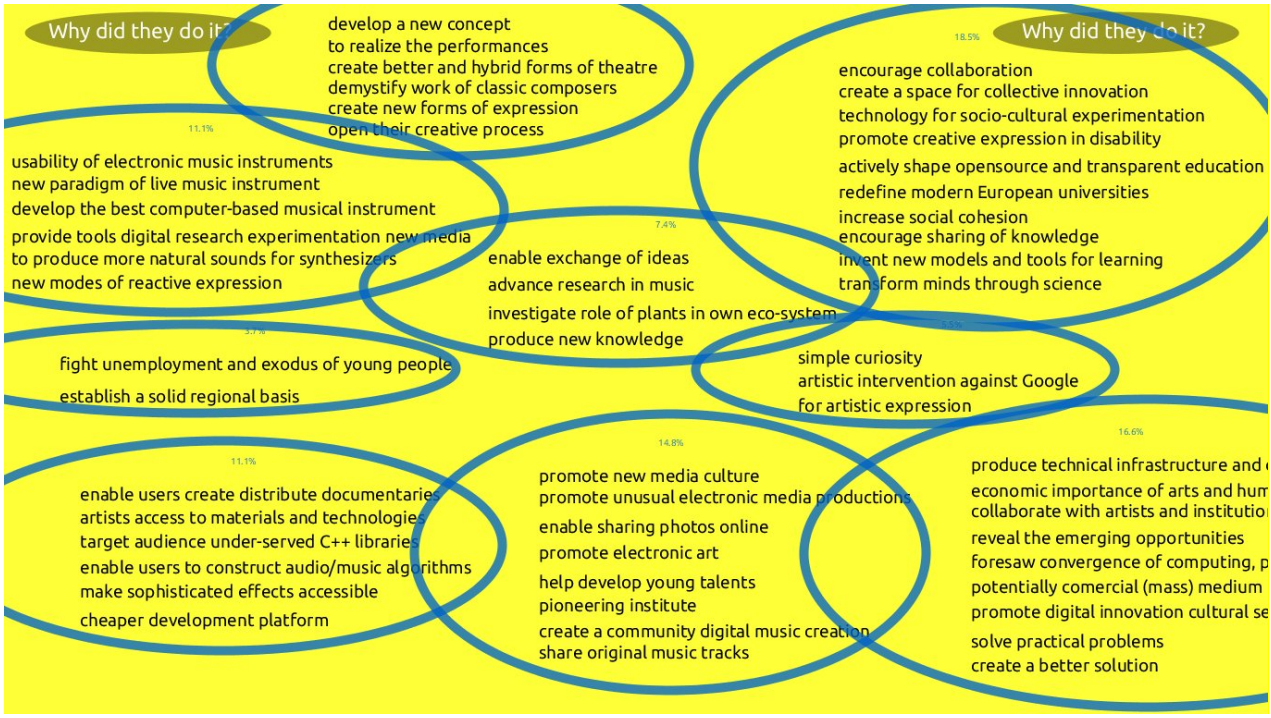

Figure 25 – Stories: Why did they do it?

The motivation behind the creation of projects is an important indicator to better understand the field in study. The range of categories of motivation is diverse and it can be characterised in 9 groups:

SOCIETAL MOTIVATIONS: the most significant group was moved by reasons not directly related with their practices themselves. Social aspects of integration, transparency, knowledge sharing, promotion of creativity and redefinition of the education system are good examples of the societal motivations behind action.

CONCRETE DEVELOPMENTS: solving practical problems, unveiling emerging opportunities and promoting digital innovation: these are characteristics revealing the will of this group to 'make things happen' and to create and to explore opportunities, in some cases even business-wise.

PROMOTION: dissemination and support of innovative activities in the field is the 3rd major motivational factor.

With equal relevance we find 3 other groups:
ENABLING: the will to make available and accessible new technologies and knowledge in technology to practitioners of art. All cases operate in open source.

TECHNOLOGICAL INNOVATION: innovation of the practices of art themselves by integrating highly advanced technologies. This group gathers mainly music related projects.

NEW FORMS OF EXPRESSION: implies the utilisation of ICT to enable new paradigms of expression. Technical advancements *per se* do not represent the main concern in this category. The materialisation of new concepts, for example

resulting from technological experimentation, is the motivational core of this group.

With a smaller presence we can find:
SCIENCE: to produce new knowledge concerning artistic and other disciplines is the main motivation in this small group.

ARTISTIC CURIOSITY: this category has a similar dimension to the former one, and includes the ones acting by simple curiosity of purely artistic purposes.

REGIONAL SPECIFIC PROBLEMS: the smallest group is composed of projects responding to concrete problems of the specific region where they developed, such as unemployment or youth exodus. Curiously enough, the projects included in this group are amongst the ones with biggest international impact in international communities. Maybe there is a correlation between regional needs and worldwide impact, but the small number of representative cases does not allow for such extrapolation. It is of course a fact that problems that are pertinent in certain regions, and hence inspire specific local problems, at the same time also play on a much wider or even global scale, which is certainly the case for unemployment.

"What was the environment?"

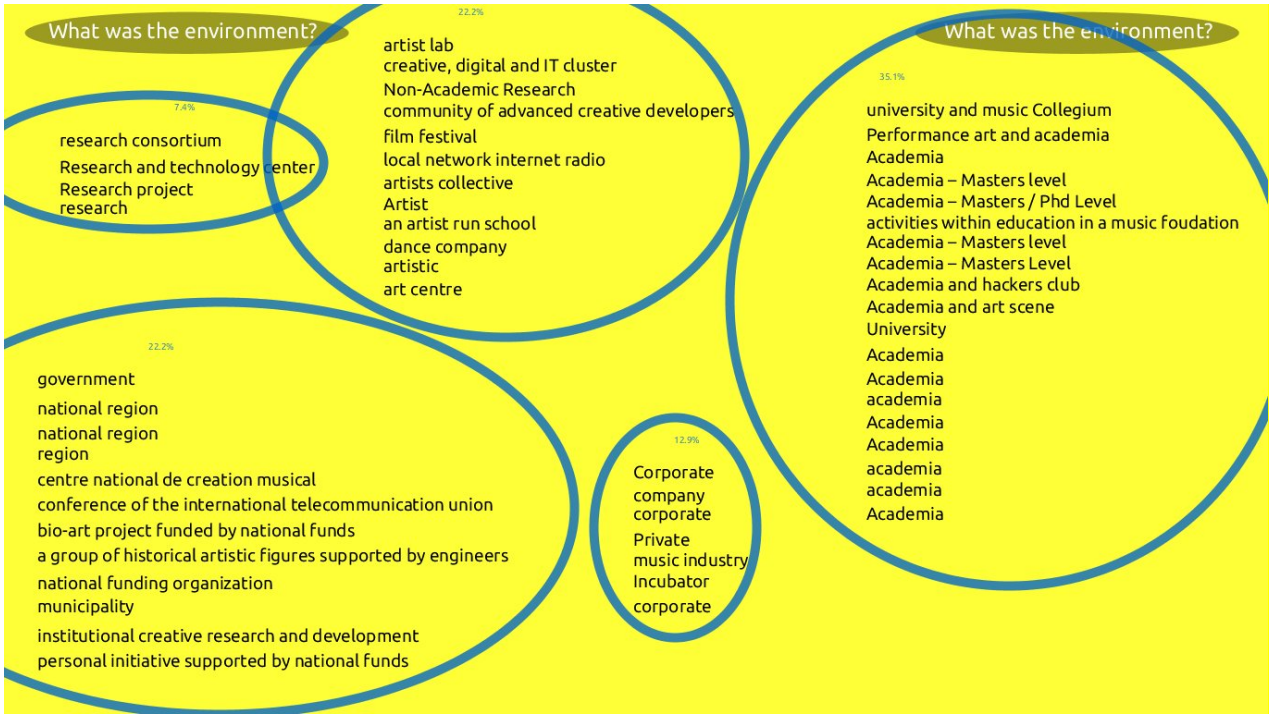

Figure 26 – Stories: What was the environment?

5 different types of environments where determined to contextualise the selected project stories: ACADEMIA; CIVIC INSTITUTIONS, at regional or national level; ARTIST RUN ORGANISMS; CORPORATE and MIXED CONSORTIUMS including all the previous typologies.

"How were they organised?"

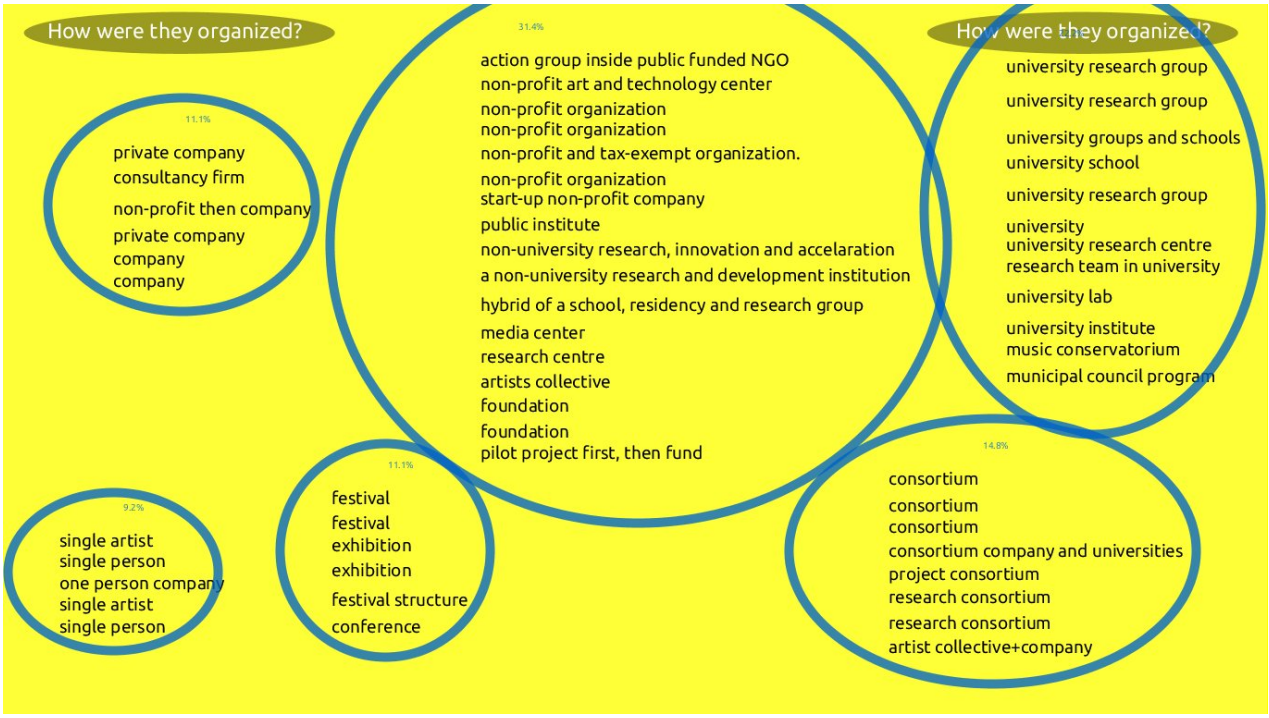

Figure 27 – Stories: How were they organised?

Organisms analysed range from single person organisms to mixed consortiums. Six main categories were found: non-profit, collective organisations including foundations and other public institutes; university, research groups in academia; consortium, formal association of mixed (private and/or public) institutions; festival, structures that function around a festival event; company, private companies; one person, single person companies or artist.

"What was the background of people involved?"

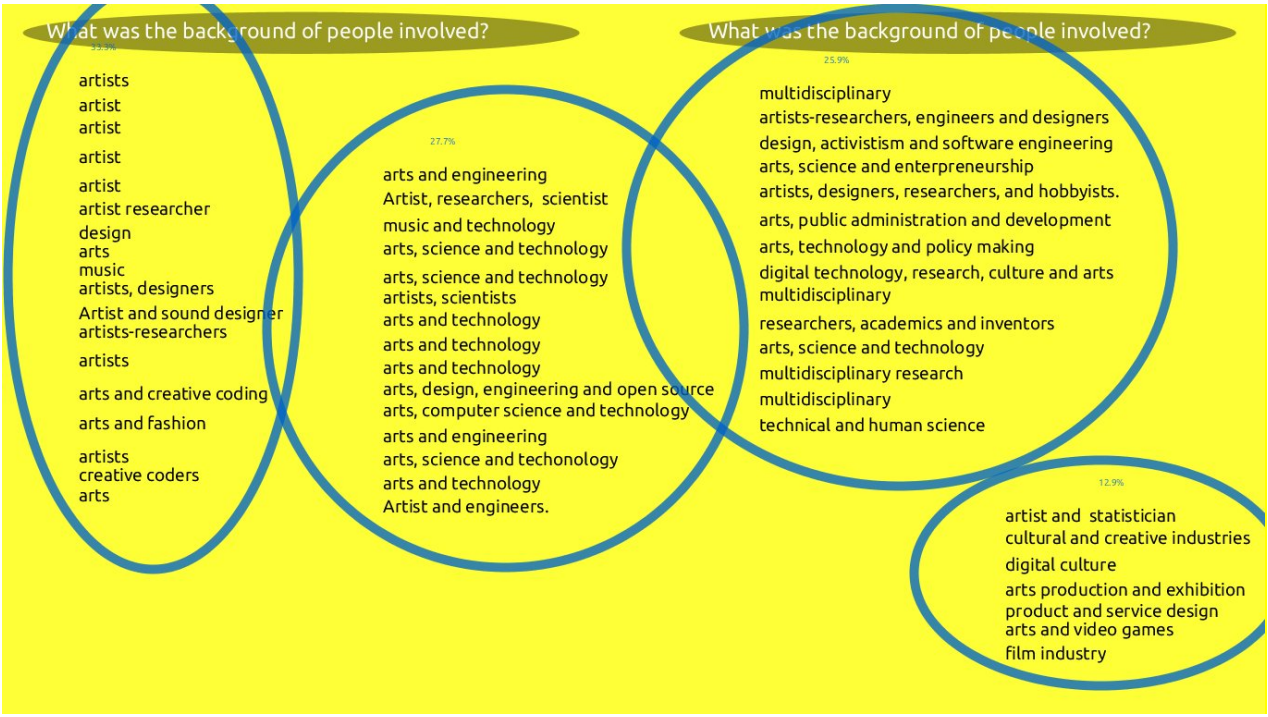

Figure 28 – Stories: What was the background of people involved?

The profiles of people engaged in the selected successful project stories are wide and diverse but can be classified in 4 main groups. It is to note however, that most of the community is composed of people with hybrid competences. They tend not to specialise but instead it is normal to observe in such profiles excellent knowledge about a few technological means in combination with a wide range of competences in diversified theoretical fields. The determined categories are, by order of relevance: artists, referring to artists with sufficient technological knowledge to produce their own ICT applications; artists and engineers, as in collaborations of artists with engineers where engineers technically support artists; multidisciplinary, a group where a wide number of disciplines meet, including variations within the arts; CCI's, referring to people that have a background in establishing the necessary conditions for the development of cultural and creative practices.

"How many were they?"

The information concerning the number of people involved in each of the selected project stories was the most difficult one to obtain, as this changes significantly throughout many projects' duration. The focus of the analysis in this respect was more in the initiating procedures, having in mind the need to devise proper policy recommendations to foster the ignition of new successful projects in the emerging field of ICT and the arts. From this approach, the notion emerged that the start of such projects often happens in very small groups of about 4 people maximum. The number of projects initiated by a single person is significant. Bigger numbers can be found in projects that started as consortiums and can range from 5 to 15 people per project. Some of the projects continued and grew, but the dimension of people directly involved never grew larger than 100 people. We can therefore conclude that all successful project stories analysed are of small dimensions, certainly initially.

"When did it start?"

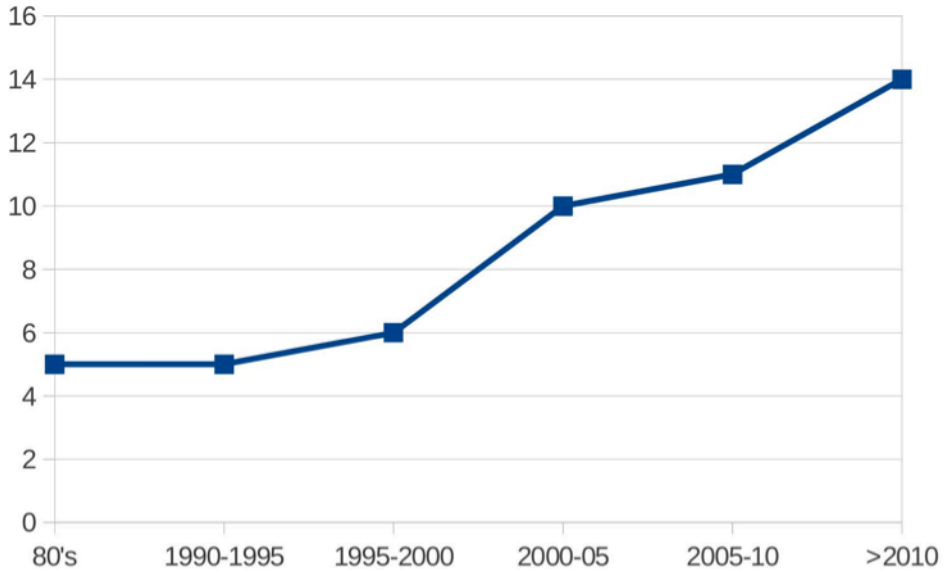

Figure 29 – Stories: When did it start?

4 of the projects started between 1966 and 1979, while the majority of the remaining projects started after 2000. A little less than a third of the projects started between 1980 and 2000, the majority of these in the 90's. As the fact that

many projects are recent shows, the number of projects in the field has grown significantly and signals to keep the same tendency in the future.

"Where were they?"

Figure 30 – Stories: Where were they?

Due to the scope of this study, the vast majority of the successful project stories analysed happened in Europe. A significant part of them where located in the US, with New York City as the major location and a few exceptions in California. 2 other projects happened in the Americas, both North and South. A couple of other projects originated in Asia. Regarding locations in Europe, London and Berlin are the centres with most projects portrayed. Belgium and Spain are next in the ranking, followed immediately by Austria and France. Portugal, Ireland and Italy are represented with a couple of projects.

With single projects, there are the Netherlands and Hungary. This does not necessarily portray the real distribution of actions in the emerging field of ICT and the arts. In that, chapter "3.2 community: analyses of map" of this report offers a better perspective. We know for example that the case in Budapest is indeed rather exceptional in its region, but the Netherlands are the home of many relevant organisms in the fields. The North of Europe is represented with single projects in Norway, Finland, Denmark and Latvia. Of course, the geographical spread of projects has no particular impact on the relevance of specific projects. The project located in Riga for example could potentially become a current and topical reference for the EU, in the way it plays into the sequence of planned actions in the context of the Latvian Presidency of EU, that are happening at the time of writing.

4.4. Comparative analysis

In order to detect relevant patterns and tendencies, potentially interesting comparisons were performed. Some of them did not reveal any meaningful tendencies or relationships. As such, the ones presented here are only those

expressing relevant food for thought, with the important disclaimer that this process of successful stories analysis is qualitative in nature and we are as such of course not speaking of statistically relevant correlations.

"What is it about? - When did it start?"
Chronologically speaking, the first projects were about bringing science and art together and focused on experimentation. After that initial period, projects focused more on 'making things happen', production and some interaction with economic markets. Later projects are more about research, some of them responding to societal and environmental issues and challenges. Knowledge transfer into society and new models of learning are also to be noted in more recent stories.

"Why is it a success? - How many where they?"
Projects led by a single person and bilateral collaborations led more to pioneering and potentially innovative work. Larger collaborations, specially the ones around 4 people, led more to support of activities such as promotion of other projects. Innovation is associated with larger scale stories, 50+.

"Why is it a success? - What was the environment?";
Publicly funded projects were more successful in becoming international references and supporting other projects. Obviously, commercially driven projects were more focused commercial success. Diversity characterises all other sorts of environments.

"What came out of it? - When did it start?"
Outcomes in the initial projects were more related with the creation of artwork and new artists. However, as some of them grew to be part of the most relevant organisms in the field, they nowadays include a wide variety of outcomes. The more recent projects tend to have outcomes that have direct impact in economy and in society. The transition between the two extremes was made in a first phase of promotion and networking activities. It followed a phase of production of more concrete outcomes such as interactive installations and other prototypes.

"Why did they do it? - When did it start?"
Consistent with the observations of *"What came out of it? - When did it start?"*, this comparison led us to understand that initial projects were focused on making new technologies available to the arts. The second phase was motivated by the potential of the outcomes of the encounters of the arts with technologies. The third phase was characterised by the will to make new things. It smoothly transited through notions of social awareness, like open-source based actions, towards motivations addressing societal challenges, proposing economical models and instigating the integration of the arts transversally in society in general through digital technologies.

"How were they organised? - When did it start?"
A chronological sequence of organisation of people conducting the projects analysed – again with the important disclaimer that this cannot be generalised to an overall tendency for the entire field this study describes – can be characterised by the following: initially organised in publicly funded institutions, then not-for profit organisations, followed by companies and finally consortiums composed of all the previous types.

"What was the background of people involved? - What came out of it?"

It is worth remarking that projects resulting in development platforms were initiated by people more related with design. Outcomes concerned with learning and education were initiated by people interested in the crossings of the arts, science and technology. All other outcomes were originated by people with diverse backgrounds, which reinforces the notion of hybridity of competences in the emerging field.

"Where were they? - When did it start?"
For the projects that were analysed, we can state that the older projects started in New York City, US, in Paris, France and Linz, Austria. Before 2000, the principal focus was in the US. After that, Europe clearly dominates the panorama of stories analysed.

"Where were they? - How many where they?"
Duos seem to be a prolific model in the US. The projects involving more initiators were located in New York City, US and Berlin, Germany.

4.5. Conclusions

Areas of activity
Activities undertaken in project stories analysed are distributed through research, development, promotion & support, production and learning. Many of the projects developed activities of different types simultaneously. Production, research and development are clearly the most prominent types of activity. Promotion & Support and Learning are notable complimentary activities. Almost half of the projects were involved in these complimentary activities. In chronological terms, an evolution is to be noted from initially more experimental actions, gradually leading to actions responding to societal and environmental challenges.

The materialisation of research results – the 'making things happen' aspect – is a fundamental characteristic of the emerging field. Therefore, the potential for innovation actions of practitioners in this field is extremely high. Hybridity of competences of practitioners allows them to simultaneously or alternately approach a circumstance in a problem solving mode, *design thinking*, and/or in a critical approach mode, *artistic thinking*. Research seems to focus on integrating aspects of subjectivity in reproducible knowledge. ICT plays a very important role in this respect of concretising subjective aspects of reality. Fundamental breakthroughs in computer science were achieved in the context of projects in the crossing of ICT and the arts.

Knowledge generation and sharing is at the basis of all activities. Peer-to-peer exchange and open-source practices are the standard of operation. Communities of developers take full advantage of network-based knowledge sharing platforms. Citizen engagement and responses to societal and economic challenges are very often part of the activities developed. When it comes to learning and education, models applied tend towards transdisciplinarity, interdisciplinarity and multidisciplinarity. Therefore, practitioners are often knowledgeable in many disciplines at a time. The community is highly educated and new masters and PhD programmes on the crossings of the arts, science and technology are greatly proliferating worldwide and form a significant part of the activities of the analysed projects.

Success factors
Project stories became successful due to a wide range of factors. Many of the projects resulted in successful products and services. Some others gave origin to radically new concepts and potential innovations in ICT. They did not however arrive at an innovation stage because they did not reach the markets or society in general. This is where targeted actions from public funding can have an impact in reducing time-to-market of these potential innovations. Other success factors are related with the relevance of those stories to the emerging field itself. Projects either became international references or gave origin to new sub-communities and projects. A small but significant group of projects became global phenomena outside their original scope. Projects of this group are mostly content sharing platforms. Pioneering and more radically innovating projects happened mostly on a small scale, while innovation towards concrete applications happened in larger scale contexts.

Outcomes
Showing results is the most common practice in the stories analysed. Interactivity based in ICT is an extremely relevant aspect in this respect. Exhibitions and artworks are often designed for public participation through electronic interaction. A considerable number of artworks was transformed into products and services. Some of the artworks were even conceived to be products since their origin, not necessarily due to potential commercial reasons but instead they where designed in order to have impact in society. Social innovation is a relevant aspect in the field.

Research and development outcomes such as papers, conferences and workshops are very common in projects. They form the basis for the creation of new artefacts and artworks. New educational models are a relevant part of the outcomes. The field of the crossing of arts, science, design and technology seems to be the natural ground for the creation and implementation of relatively recent paradigms such as transdisciplinarity. As said before, new master courses and PhD programmes in this field are greatly proliferating worldwide. In one specific case, the unification of three universities into a new paradigm gave origin to a new university fully dedicated to the contributions of the arts and sciences to business.

Motivation
The range of motivations at the origin of the project stories is wide and diverse. Practitioners are mostly moved by ulterior motives rather than the success of their own personal development. These motives can be of social or existential nature. Very few practitioners were moved by matters of economy or commercial profit. However, the creation of concrete developments is at the top of the motivational background, as well as promoting them amongst communities of practitioners. Making technology accessible to artists, innovating technology and forms of expression are common motivations. Pure artistic curiosity and generation of scientific knowledge are also in the list of motivational factors. Finally, regional development was the original motivation behind the most worldwide famous and relevant projects in the field.

Context
Environments where the stories developed are mostly dominated by academia, but civic institutions, artist-run organisms and companies are becoming increasingly relevant players. This tendency is expressed in the growing popularity of dedicated project consortiums.

Organisation
Project participants associated mostly in the form of non-profit organisations, research groups in universities, consortiums, festival structures and companies. Single person organisms also appear in a considerable number.

Background competences
Competences of practitioners are generally hybrid. Most of them have many areas of specialisation. The observed chronological tendency started with collaborations between artists and engineers and transformed into multidisciplinary groups. As a consequence of their activity, many practitioners became knowledgeable in many areas, leading to transdisciplinarity.

Dimension
It is clear that the origin of the successful project stories is mostly in one person or in small groups of people.

Science, technology and the arts as a field
The number of recent projects is huge in comparison with earlier ones. The field is emerging very rapidly and consistently, certainly in numbers, but also in maturity of initiatives and hence often in quality.

Geographic distribution
The majority of the project stories analysed were based in the EU. A significant part of the project stories happened in the US. Within EU based projects, most were in Central Europe, while in the US New York City was the host to almost all the projects analysed. A growing predominance in time of EU based projects is to be noted. Again, the qualitative methodology used for this chapter does not allow for us to have a critical mass of projects from which we can extrapolate general statistically relevant tendencies. Nonetheless, we can perhaps deduct that the recent EU climate of R&D&I and the Arts seems favourable.

5. RECOMMENDATIONS FOR A STRATEGY FOR ENGAGEMENT OF ICT WITH ARTS (STARTS)

5.1. Preamble

Artist practices produce knowledge. Artistic practices in technological contexts produce concrete applications and new technologies. Therefore, a strategy for engagement of ICT with the ARTS is about the integration of artistic practices as ways to produce new knowledge, similarly to what happens in scientific or engineering practices.

Only the recognition of artist practices as research methodologies in technology will produce concrete and interesting results. Within the actual effort in HORIZON 2020 to achieve concrete innovations out of the funded research projects, the arts, if properly integrated, can be instrumental in concretising the knowledge produced. Artistic practices in technological contexts are naturally close-to-market as technology is their medium of expression. In this context, artistic works are usually prototypes of new technologies or applications.

Since 1964, when Marshall McLuhan introduced the very famous sentence "The medium is the message" in his *Understanding Media: The extensions of Man,* novel practices of art were definitely transformed. Nam June Paik was one the most relevant agents in this field, and has recently been recognised as an innovator in technology as a recent exhibition in NYC demonstrated. These facts have to be at the basis of any reform aiming at a viable inclusion of the arts in ICT research contexts.

Equally important is to clearly distinguish the STARTS discourse from the CCI discourse. STARTS – Science, Technology and the Arts is about the integration of artistic practices in research contexts. CCI – the Cultural and Creative Industries discourse is mostly about exploring the impact of cultural practices through creative industries. One could look at the CCI effort as similar to the knowledge transfer effort in science and technology. While the knowledge transfer discourse is about the impact of science in society and economy through technological development, the Cultural and Creative Industries discourse is about the impact of culture in society and economy through creative developments. Although STARTS can obviously be instrumental in increasing creativity in general, it should be significantly deeper than that. STARTS should be about financing artistic practices within research projects similarly to what happens with scientific practices, engineering and management. This is because, as this study demonstrates, artistic practices can produce concrete, reproducible knowledge materialised into innovative technological forms.

5.2. Strategic challenges

Research Outputs

In order to make STARTS happen in a significant way, according to the thoughts detailed in the preamble, the Commission should pay special attention to the reforms that might be suggested by STOA as reforms of EU research results. STOA provides the Assessment of Scientific and Technological Policy Options for the European Parliament. It launched a study with a final report delivered in April

2014 entitled "Measuring scientific performance for improved policy making".[29] The study reveals that in some countries in the EU, artistic outcomes such as artworks and exhibitions are already considered valid research results. Ideally, these practices would be expanded throughout the EU, backed up by a policy framework enabling this.

Independently of any impact that STOA might have on the regulation of research results in the EU, the recognition by the Commission of artworks and exhibitions to be valid research results would be a fundamental step to take. In such a scenario, artistic practices could be quantified in terms of research results, similarly to what already happens with scientific practices. This would to allow for a levelled integration of arts and sciences.

STARTS community

This study, and more specifically the survey, reveals that the community of ICT and art is not always aware of the opportunities already existing for the arts in DG CONNECT. Furthermore, although some of the participants of the community are integrated in academic contexts, they may not necessarily be ready to face the bureaucracy involved in applying for research funds in HORIZON 2020. On the other hand, and after the natural initial reluctance, nowadays an increasing openness of some of the already established agents in EU research grants can be observed with regards to integrating artists in their teams. This does not mean there are no more barriers. For example, the non-explicit reference to the arts in the text of the topics of many ICT calls could hinder the further integration of artistic practices. Some call topics are already more open than others to include the arts in some form, such as the calls related to CAPS and IoT[30], but even there, this remains somewhat of an issue.

Nonetheless, the study reveals that many actors in the community describe themselves as artists (cf. 3.1.3). It would therefore be advisable to make efforts to engage more participants from scientific and technological fields in the crossings of ICT and art at the same time as engaging more artists in ICT related research programmes. Engagement will require targeted effort, as the survey responses hint at the fact that, even though the community is highly used to collaborative and project-based work, potential key players are often not aware of the available opportunities. An umbrella meta-project to promote smaller projects could be instrumental in this initial phase, in analogy with recently launched sector-specific programmes coordinated by intermediate organisations in the context of Future Internet technologies.

Instrumentalism risk

There is a risk of some potential members of the STARTS community becoming reluctant to consider participating in research teams due to the fear of instrumentalism. This is a clear result of the survey. We believe however that this fear can be overcome, first and foremost by allowing artistic results to count as deliverables in themselves (cf. supra), and second by exposing potential actors to the transparency principles of the processes in EU research grants. Again, the idea

[29] Mahieu, Bea, Arnold, Erik, & Kolarz, Peter "Measuring scientific performance for improved policy making", Brussels, STOA, 2014.

[30] Collective Awareness Platforms for Sustainability and Social Innovation, call ICT-10-2015; Internet of Things and Platforms for Connected Smart Objects, call ICT-30-2015

of setting up an 'umbrella project' could have a clear relevance in opening up the community, by demystifying all bureaucratic processes involved.

Methodological Challenge – artist or designer?

A main challenge will be to combine artistic creative freedom with technology transfer processes. The survey points out tensions between the need to be cutting-edge versus the risk to be too new; the need for being open and flexible versus standard project needs of having well-defined targets. Balancing these tensions as well as foreseeing financial support will be instrumental to build a sustainable field of practice.

Some of the survey responses were accompanied by additional interviews or discussions with respondents known to the research team, online or face-to-face. One interviewee exposed a very good example of this challenge. She said that if approached as an artist with a technological challenge she would go deeper in the analysis of the challenge, with a critical eye. However, if approached as a designer, she would be driven by finding a solution. This example is highly representative of the hybrid competences of the community. The potential of the integration of artists in research teams seems to lie in their capability for deep exploration of ideas and their critical approach to technology. But aside from this, a double potential exists in the general hybridity of practitioners in the field. It is beneficial to consider that many can act not only as artists but also as designers.

As such, the real challenge will possibly be posed to managers in charge of research projects including artists. They will have to have the sensibility to, at the right moment and in the right manner, trigger the shift of participants between acting as artists or as designers. In here, we can also find a field for improvement and maybe even innovation of management techniques and methodologies.

5.3. Conclusion

In light of this, a number of strategic scenarios are possible. These scenarios are not necessarily exhaustive and could be implemented at the same time.

One approach is to fund artistic activities in the context of ICT research projects with a fixed percentage of the overall project cost. This is similar to what is put in practice, for instance, in public building in some countries like the UK: 2% of the overall cost of the building is invested in public art. This could be a good transition option, but it runs the risk of, as quoted in the survey, art being 'used as a poor justification of purely scientific projects'. As such, it may not be sustainable and it may also not sufficiently foster the significance of concrete inputs to innovation from artists- researchers.

A second strategic approach could be to allow for the recognition of artistic research as a valid practice in the production of knowledge, i.e. on the same level as recognised scientific and engineering practices. In this case, artists-researchers, or teams of artists and technologists or ICT specialists, could for example be evaluated on their technological capacity and potential towards innovation, similarly to current practice with other experts in ICT proposal evaluation. Combining both options could for example lead to a scheme whereby as an initial incentive, the inclusion of artists-researchers in project teams could count as a (small) positive factor in evaluation.

A third option is to ensure that the acceptance of works of art and exhibitions as research outcomes would be standardised at a EU level, i.e. generalising this practice as it happens in some EU countries, as we described above in the context of STOA.

Again, these scenarios do not necessarily exclude each other. A well-considered implementation of options such as these could be instrumental for nourishing the emerging field of ICT and arts in the European Union.

6. Analysis of online community and continuation of online activities

6.1. Introduction

From the inception of the study, the important matter of online community was discussed with the study team and the advisory group. Within a study which has a beginning and an end, there is always a risk that an online community becomes equally temporary, if it does not build sufficiently on the existing community out there and if it develops itself as a separate 'target platform' where users have to go to specifically. In terms of sustainability, keeping any platforms developed during the study online after the study duration would not in itself engender sustainability of the community around the platform. For that reason, it is crucial to not only engage with the community throughout the study's own platform, which has been described in detail in chapter 3, but also involve social networking and reach the community where they already are.

As such, aside from the own website, the online community is active in a Facebook group page, a Twitter account and a LinkedIn account. The 2 webpages are related with 2 different projects: not only the study that this text reports on, but also the FET-ART project, the study's precedent CSA funded under FET that brought artists and technologist together to collaborate on specific project ideas. The 2 websites will be merged before the end of the second quarter of 2015. Because of their affliliation with the previous project, the Facebook group page, the LinkedIn account and the Twitter account were initiated before the start of the study. It was decided to use the study resources to maintain these existing accounts instead of creating new ones. The Facebook group page is the online medium used the most by the community. Therefore, it can also be seen as the most representative to characterise the community and it is fully analysed here. It is clear that the sub-community associated with the study's website, as e.g. reached through the survey, was already described in chapter 3, 'Mapping the ICT & Art Connect Community'. In terms of sustainability, this chapter will end with a section on concrete options of online-based activities for the maintenance and development of the online community here described. These will be presented as a consequence of insights brought forward by the analysis.

6.2. Facebook group page analysis

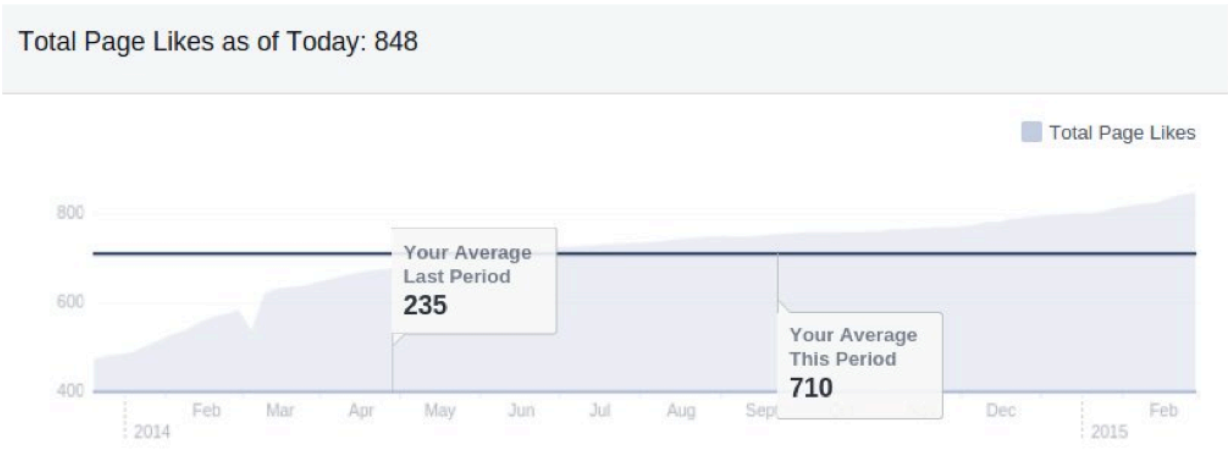

Figure 31 – Facebook likes growth curve

The study formally started on the 20th of December of 2013. At the start of the study, the existing Facebook group page had 473 likes; by the end, it reached 847 **likes**. The initial likes were originated as a consequence of the ICT & Art CONNECT 2012 and ICT ART CONNECT 2013 events, but their number mainly grew significantly during the FET-ART project. During the course of the study the number of likes grew steadily with no peaks to be noted except one negative peak in February 2014. On the 14 of February of 2014 there were a total of 584 likes. This number decreased to 537 in the following 4 days. A total of 47 unlikes happened then. The recovery was rather fast: in one day, on the 21st of February, the number of likes raised from 547 to 612. No specific event could be identified as possible cause of this peak, neither the negative peak nor the recovery. The average number of likes of the period in analysis is 710, while in the correspondent previous period it was 235. This indicates that the online community, even though it existed previously, still grew significantly in the period of analysis.

The great majority of page likes in the period of analysis originated directly on the page itself. Page suggestions represent only about 10% of the likes gathered. No paid likes were found. All likes happened organically as consequence of the activities in the page as well of the activities of the study.

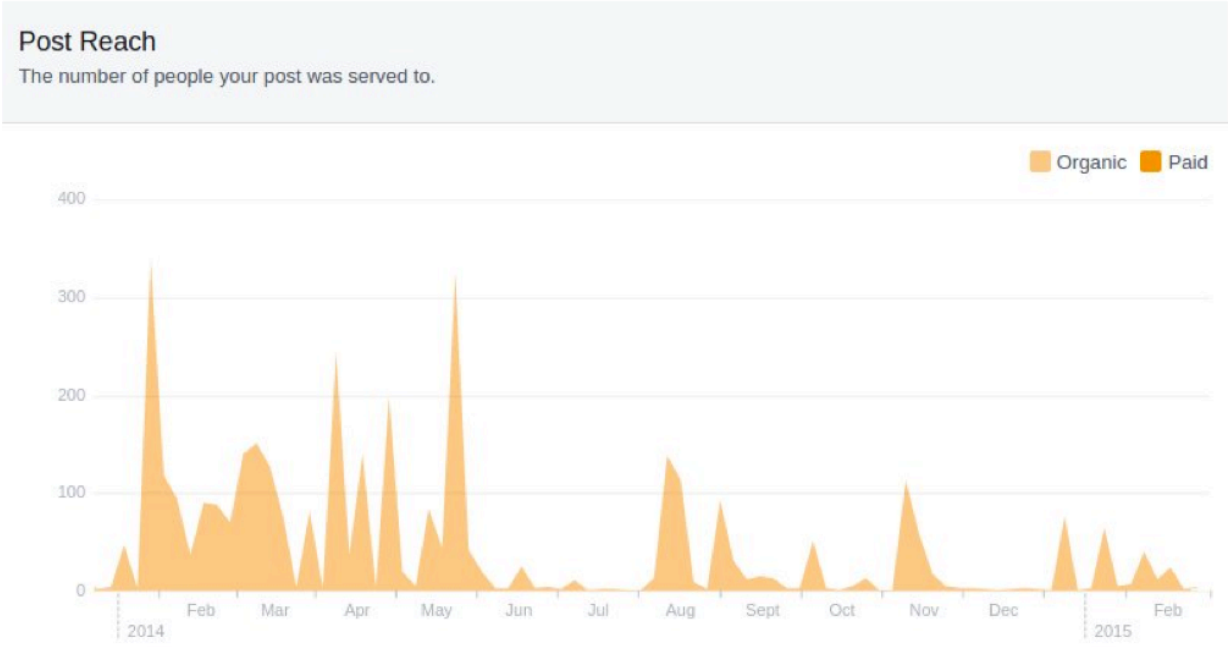

Figure 32 – Facebook posts reach curve

The next metric we will address is **reach**. The metric of people reached refers to the number of different Facebook timelines each post was displayed in. The average of people reached in the period in analysis is 35, while in the correspondent last period it was 43. The curve of the evolution of people reached in time is composed of peaks associated with posts on the group page. The great majority of the posts originated through the page's group administrators. The group of page administrators is composed of people involved in the FET-ART project, people running this study as well as EC officials. The maximum peak was 336 people, and this was reached on 13 January 2014. A second peak of the same order happened on 8 May 2014, with 324 people reached. 5 peaks are above 100

people, while the majority of them are below 100 people. The most intensive period of peaks both regarding amplitude and frequency happened between January and June 2014. December, June and July of the same year were the quieter months of the reference period. Again, no paid reaches are to be noted. Regarding actions associated with reaching more people, it clear that likes are the driving force. Comments and shares are relatively rare.

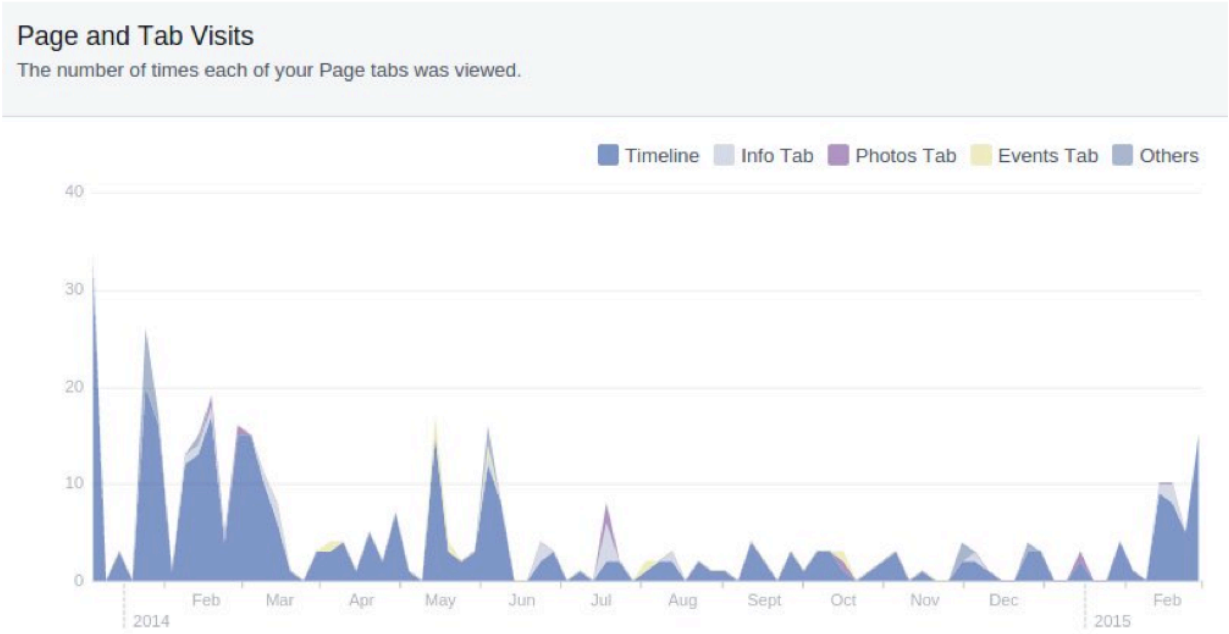

Figure 33 – Facebook page and tab visits

Aside from *likes* and *reach*, **visits** are another interesting metric. Visits refer to the number of times each of the group page tabs was viewed. The most intensive period happened from December 2013 to March 2014. The following more intensive periods, both of about a month duration, happened between May and June 2014 and January and February 2015. The average number of views of the Facebook group page in the period of analysis is 4 visits per tab. The average of the previous period was 9 visits per tab. The major origin of visits outside of Facebook is the www.ict-art-connect.eu website.

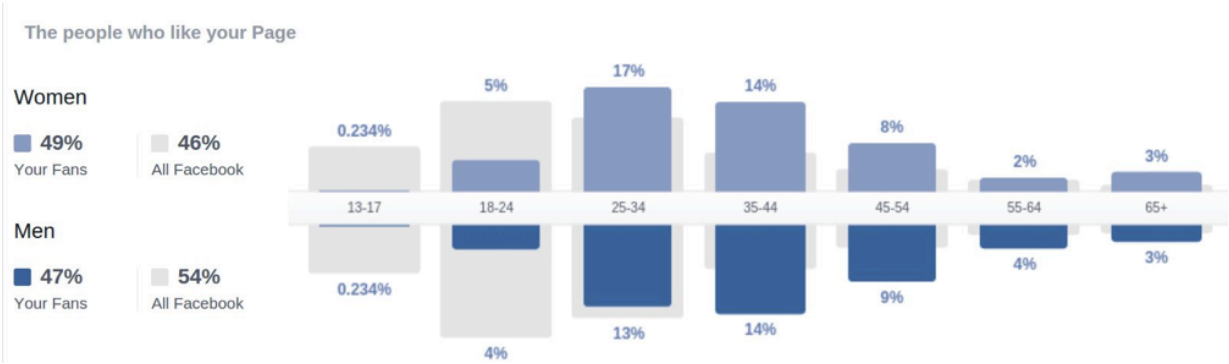

Figure 34 – Facebook gender distribution

As stated, the total number of people that like the ICT & Art Connect page is 847. When it comes to gender, we know that out of this number (at least) 49% are women and (at least) 47% are men. We do not have insight into the full gender balance; which is most probably linked to privacy reasons with regards to

personal profiles of people liking the page. Age and gender seem to intersect slightly. The majority of people in general are between 25 and 44 years old. When it comes to women, the majority are between 25 and 34 years old, while within the group of men, there is a quasi-even distribution between the ranges of 25-34 and 35-44 years old. A similar distribution can be found when it concerns to people reached by the page's Facebook posts. The difference is that this metric relates to a stronger predominance of people between 25-34 years old in both genders. Regarding people engaged with the page's posts - meaning people that have liked, commented or shared the posts, or liked the page in the last month of the period in analysis – a wider engagement from women can be noted, 50% in opposition to 46% of men. Women between 25-34 years old are the most relevant group, directly followed by women within the 35-44 years old group. Men of between 35-44 years old are the most relevant group, while the one directly following is the group of men between 25-34 years old. Contrary to what happens in the women's group, the difference between the two major groups of men seems significant, of about 6%.

Regarding **location**, the great majority of people that are fans of the webpage are from the UK, 269. Below that, in the range between a maximum of 68 and a minimum of 20 people, the following countries can be found in descending order: Belgium, Spain, Italy, United States of America, Netherlands, Germany, France, Canada and Austria. To be noted is the dominance of Europeans as well as the presence of North Americans. London is clearly the major city where people that like the page come from, 141. Right after that is Brussels with 49 people liking the page. In the range between 30 and 11 people liking the page, we can find the following cities: Brighton, Barcelona, Berlin, Edinburgh, Vienna, Amsterdam, Paris and Madrid.

With regards to the metric of people reached, there is again a wide predominance of the UK, with 188 people, followed by Belgium, Germany, Italy, Austria, Canada, Spain, Ireland, United States of America and Israel. In terms of cities where people have been reached, London is again predominant, but this time the difference is somewhat smaller and London is more closely followed by Brussels: 89 and 49 respectively. Between 39 and 15, we find in descending order: Vienna, Berlin, Tel Aviv, Montreal (Quebec), Bratislava, Edinburgh, Barcelona and Brighton.

In general, the number of people engaged with the posts per locality is rather small. Concerning the countries, the range is between 13 and 4 people, while in terms of cities, it is from 8 to 4 people. Curiously, some of the countries from where a smaller number of likes originate are the ones that come on top when it comes to engagement. Such is the case of Denmark, Spain, Finland and Switzerland. In terms of cities, the ones that showed a large number of likes, such as London and Brussels or Berlin, show up mid-rank with about 5 people engaging on average with the posts. On top is Gijón, followed by Trondheim, Copenhagen and Cincinnati, Ohio, USA. Finally, English is clearly the dominant language of people involved with the group page. Less representated are French, Italian, Spanish and German.

6.3. Twitter Account Analysis

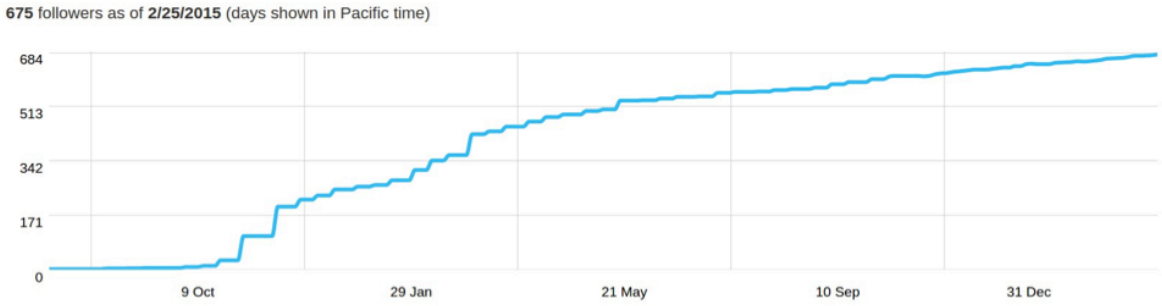

Figure 35 – Twitter followers growth curve

By the end of January 2015, the ICT & Art Connect twitter account had 663 followers. On the 20th of December of 2013, the date of the formal start of the study, it had 252 followers. In had 30 followers at the end of October of 2013. The initial growth, happening before the start of the study, during November and December 2013, coincided with a sequence of an intense period of EU promoted activities: the ICT2013 conference in Vilnius, in Lithuania, and the ICTARTCONNECT 2013 event that gathered a considerably large community. The threshold of 500 followers was crossed in May 2014. Since then, growth has slowed down, but it has still kept a steady pace of about 22 new followers every month. Growth is there regardless of the fact that the amount of tweets in itself is relatively limited. In terms of **gender**, the majority of followers is male. Only 35% of the followers are female.

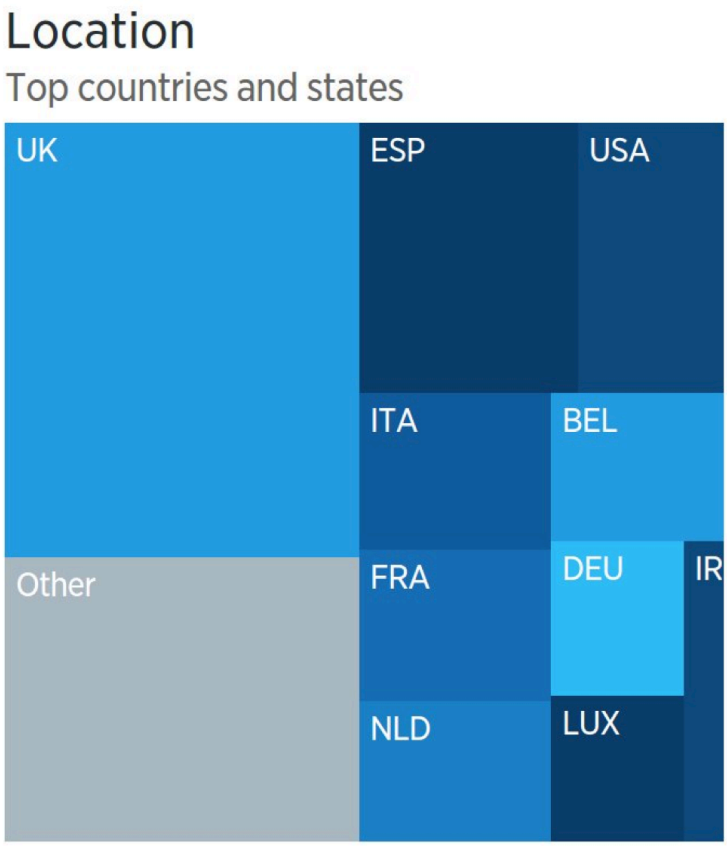

Figure 36 – Location of Twitter followers

In terms of **location**, 30% of the followers are from the UK. The most representative group right below in terms of percentage is from Spain with 11%. In smaller percentages we find followers from the United States of America, Italy, Belgium, France, Germany, Netherlands and Luxembourg. 2% of the followers are from Ireland and the remaining 19% are divied over different countries with an insignificant proportion for each of them. Top city is – once again – London, with 12% of the followers. Gathering 6% and less of the followers we have in descending order: Barcelona, Luxembourg, Brussels and Amsterdam.

In terms of **interests**, the followers of ICT & Art Connect have a great interest in technology in general. Science, Design, Performing Arts and Painting are additional themes of interest to technology. Followers are also interested in Politics and Business.

6.4. Conclusions

The online community is composed of a significant number of participants, spread over a number of different platforms. It grows steadily independently of the stimulus of the 'official' administrators of the social network accounts. This fact is even more visible on Twitter, where the number of followers keeps growing even with only a small intervention from the administrators of the accountWith regards to Facebook, people that were involved in past projects associated with the account keep being active online beyond the end of those projects. The community therefore appears to be sustainable beyond any projects that it is related with.

Nonetheless, it is to be noted that the online community is a direct result of the actions promoted by the Commission under the umbrella name of ICT & Art Connect. It did not exist before it was started with the first Commission driven actions back in 2012. Its impulses of growth are always the result of more intense activities of community gathering such as workshops, conferences and exhibitions. As such, the community did not emerge entirely bottom-up. The online behaviour of the community clearly indicates that people are vividly looking for opportunities to be engaged in new projects and activities. The more relevant indicator in this community demand is the general nature of the posts and tweets: they are mostly about opportunities outside of the Commission context as well as about successful projects on the crossings of art and ICT.

The online community, even if already of a considerable dimension, is clearly in its beginning and still has a great potential to grow significantly. At the time of the writing of this text, partial access to databases from both Ars Electronica (Linz, Austria) and Transmediale (Berlin, Germany) was granted and the resulting data is being processed. The available data shows that the number of organisms associated with the two main festivals in the World in what could be commonly described as the field of *new media* is very big. The estimation at this stage is that the ICT & Art Connect Community could grow up to more than 7000 participants with just the simple addition of the databases of the festivals.

We can also expect that further growth of the community may be achieved upon expanding European Commission funding in this area of ICT & Art. However, we must note that, based on our analysis and experience, it appears that the community's engagement does not simply seem to result directly from funds invested. For example, many of the funds put in the activities promoted by the

Commission under the umbrella of ICT & Art Connect were solely applied for covering expenses associated with travelling and exhibiting, and not for creation in itself – i.e., creative fees were not paid. And yet, the community has emerged and appears to be at least partially self-sustaining. Perhaps this might be due to the fact that art is often not first and foremost related to monetary incentive. Artists are often mostly driven by ideas and recognition of their work.

The online community seems to be well balanced in terms of gender on Facebook. On Twitter, however, more men than women are following the account. The age ranges suggest that many of the people involved are mid-career professionals. London is clearly the current geographic epicentre of the online community. Brussels is the second most relevant city, but with already a considerable difference. Curiously, Berlin and Vienna are commonly known to be important centers of practitioners in the emerging field of ICT & art, but they are not extremely well represented in the community analysed within this study.

In terms of participating European member states, again a great prominence of the UK is to be noted. Belgium, Italy, Spain, the Netherlands, Germany, France and Austria are the other most represented countries. Outside of Europe, the United States of America have a relevant presence in the community, equivalent to some of the more representative European countries such as Belgium. Canada is the only other non-European country with a strong presence in the community. A possible reason for the predominance of the UK in the community might be the fact that the first CSA on the matter, the FET-ART project, was composed of a considerable majority of partners from the UK. The relevant presence of the United States of America is of no surprise, simply owing to the fact that the USA has often been leading the emerging field since the 1950s. Community members' interests vary widely, but science, design, performing arts and painting seem to be some of the prominent areas of interest of the people of the community.

6.5. Continuation of Online Activities

We have already addressed the fact that that the online community is significant and somehow self-sustainable. However, this does not mean it is close to fulfilling its full potential. In order for the community to thrive and prosper, it needs de-centralisation efforts associated with expansion efforts. Activities of community gathering, such as roundtables, workshops, conferences and exhibitions seem to have concrete and tangible effects on the activity and engagement levels of the online community. Therefore activities in cities already present in the community and others commonly recognised as centers for ICT & Art are advisable. Commission promoted events targeted to cities such as for example Berlin, Amsterdam, Luxembourg, Vienna, Barcelona, Madrid, Gijón, Paris, Lisbon, Copenhagen, Helsinki, Riga and Trondheim would most probably expand the online community significantly in a decentralised manner. These activities would on the one hand reinforce the relevance of some of the cities already present in the community. On the other hand, they would open doors in new places not yet represented in the community.

Aside from the strengthening of the community through further activities, the website continuity is also foreseen. As per agreement between partners involved in both the FET-ART project and the ICT ART CONNECT.study, both websites will be merged in April 2015. The 7000+ new entries in the database associated with the website will be added in this process. The management of the social network accounts is already distributed between the partners and the Commission as well.

In the context of the calls presently open in HORIZON 2020, a pilot project in the context of the CAPS topic could be instrumental for the enlargement of the online community. As presented in the successful project stories chapter, online platforms based on peer-to-peer knowledge exchange are proven to be quite successful in establishing and maintaining online communities. Good examples of this are Processing, Openframeworks and Arduino. The open exchange of specific case driven technical knowledge is at the basis of those communities. Therefore, they are considered examples of digital social innovation. They allow for the shared creation of knowledge as well as concrete technical applications. A meta-platform on knowledge sharing and co-creation in ICT & Art, combined with crowd-funding mechanisms, would take the existing online community to the next stage of collaboration: the production of concrete new technological applications.

7. CONCLUSIONS

There is a field of artistic practice contributing to innovation of information and communication technologies. It emerged out of the crossings of several fields of art and science having technology as common ground. In this intersection, new digital technologies and applications are the main outcome. The emerging field is now establishing itself as one of the significant drivers of innovation in the world. The catalytic aspect of artistic practices is a commonly refered aspect amongst actors in the field. In its realm, creativity in digital technologies often finds natural ways to direct proof-of-concept. It is exactly here that the field finds its contact points with neighboring fields of research and practice, namely industrial partners. The achievement of concrete practical outcomes is one of the most important aspects when it comes to technological transfer to society. The research aspect of the emerging field of ICT and the arts is of crucial importance. Artistic practices of research in technology demonstrate to be extremely effective in delivering concrete results. Experimentalism, as one of the characteristics of contemporary artistic practices, has a strong role in the catalysing effect of the arts in innovation in ICT.

One of the main characteristics of the communities constituting this emerging field is that they are not moved by a financial drive. This has been reported in several conversations with the field in the context of this study, and is one of the main problems of people dealing with projects in the area of creativity. Coordinators and support actions in ICT can be seen to have some difficulty in gathering significant contributions from the main players in the field, due to the fact that the normal incentives are not enough. Most of the actors are driven by clear visions of technology, normally concerned with philosophical, existential, environmental and/or societal issues. This aspect is perfectly in line with European visions of technology as demonstrated in the general principles of Horizon 2020. It is also here, in this aspect of non-direct financial results of activities in the field of ICT and art, where one of the core aspects of creativity seems to lie: the ability to draw new ideas is somehow related with not having a concrete target. Nonetheless, because the medium of expression is digital technologies, wherever such a creative deambulation leads, there will always be concrete, palpable results.

Keeping this in mind, the integration of artists in research teams in ICT has mutual benefit to all participants. Compared to more traditional researchers looking to 'think out of the box', more creative ones are more likely to 'completely break the box' and come out of this process with genuinely new ideas. The more creative actors will on the other hand be helped by other researchers to foster better dialogues with society, and as such, contribute to society in general. A notable hybridity of competences of many practitioners in the field of ICT and art is one fundamental aspect for the integration of artists in ICT research teams. The ability of artists to deeply understand technological aspects can be seen as a main success factor in multidisciplinary teams integrating artists. A common problem in research teams, more specifically in the early art-science collaborations, was a too strict 'territorial' definition of practice. In recent communications, in general terms, the Commission has been reporting on the need to eliminate what is normally denominated as 'disciplinary silos'.[31] It seems to be understood that this elimination is crucial for true innovation in general, and in our context specifically

[31] A good example of this general discourse can be found here: http://www3.ebu.ch/contents/news/2014/09/new-juncker-commission-to-break.html

for true innovation in research. Similarly, from those past art-science collaborations, it was reported that mistrust could emerge too easily. For example, either scientists would try to take advantage of artists to better illustrate their concepts; or, vice-versa, artists would take advantage of scientists to better justify their visions. Nowadays, against the background of a global common aim of achieving transdisciplinarity, we observe that hybrid practices, often those integrating artistic practices, are at the forefront of successful new research practices. A good example of such endeavours are the reforms undertaken by Aalto university, looked at as one of the successful project stories in this study.

Historically, the origin of the movement of artists dealing with technology is in the US. Mainly from the 1950s onwards, the crossings of the arts with science, engineering and technology started to be common practice. Frank Malina was the main promoter of the field of art-science in those days. Marshall McLuhan changed the state of play fundamentally by theoretically declaring the medium to be the message. This new conceptual shift detached the artist from content production and allowed for artistic practices more related with the development of systems. A phase where engineers were supporting artists to develop and implement their technological visions was instrumental for the development of technical competences of artists. *Experiments in Art and Technology* was one of the fundamental actions in this movement of engineers supporting artists. MIT established the concept of *medialab* – with it, a new era started, an era where disciplines and competences began to merge. Europe became far more central in the emerging field of ICT and art with the birth of Ars Electronica in Linz, Austria, in 1979. About a decade later, ZKM and Transmediale were born in Germany. Ars Electronica has evolved in a manner more focussed on industrial innovation, while Transmediale has become more focused on social innovation. Roy Ascott is a key figure in the theory of the crossings of art, science, technology and consciousness. He has guided many generations of artists-researchers to overcome basic concepts such as modernism and post-modernism, or digital and post-digital, helping them to focus on more innovative concepts such as cybernetics, telematics, post-biological and technoethics.

From the survey we understand that the community is predominantly nomadic and not always institutionalised. Participants are incredibly highly educated and most consider their main activity to be the practice of art. However, research is a very important aspect of their practice as well. They are technically competent, with a wide range of technological and ICT skills, including computer programming. The community of the survey considers cross-disciplinary collaboration to be of importance. Several actors advise, as a key for success of art-science collaborations, that artists should be given central roles in such projects. Project results being ‘too new’ is seen as a main risk while being involved in practices of ICT and art: a crucial challenge rightly pointed out by the community lies in the balance of projects between being open and flexible versus having well-defined targets. This balance does indeed seem to a key for success: the successful project stories analysed tell us that organisms in the field often realise many different activities simultaneously; including research, development, promotion & support, production and learning.

The 'making things happen' aspect is a fundamental characteristic of the emerging field, which is reflected in the fact that success factors are often related with innovative products and services. New concepts are also a very important type of result, and the knowledge that these concepts imply is often shared in an open way. Innovative exhibitions and artworks, such as participatory interactive

installations, form a tangible type of outcome that is also often present. Nonetheless, more traditional research outcomes such as papers and conferences can also be found. Extremely relevant other outcomes are new educational models that seem to be at the forefront of innovation in education.

Practitioners are mostly moved by a large variety of motives other than the success of their own personal development. Maybe for this reason, their practice is often integrated in a large variety of contexts, such as academia, civic institutions, festivals and artist-run organisms. More recently, integration in companies is also becoming more common. In a considerable number of cases, practitioners act as single person companies. This is consistent with the fact that most of the successful stories where initiated by small group of people or a single person.

Competences of practitioners are generally hybrid. The field is emerging very rapidly and consistently, certainly in numbers, but also in maturity of initiatives and hence often in quality. The majority of the project stories analysed were based in the EU, but a significant part of the project stories, and certainly some of the earlier ones analysed, happened in the US.

Taking into consideration all of these aspects and defining characteristics of the emerging field and its practitioners, we can only reiterate that a strategy for engagement of ICT with the arts should focus on the integration of artistic practices as ways to produce new knowledge, similarly to what happens in scientific or engineering practices. Sipmply put, artists should be integrated in ICT research teams because artists' practices produce *knowledge*. The added value of this integration is in the fact that artistic practices in technological contexts produce concrete applications and new technologies.

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9. ANNEXES

ANNEX I – Survey questions

This annex represents the Qualtrics software survey questions in text format. Dotted lines represent open-ended answesr (i.e. free-form text fields in the survey). Where multiple dotted lines are shown, they represent the amount of input fields provided with the survey question.

Welcome at the ICT&ART connect survey

Thank you very much for taking time for the ICT&ART connect survey!!

This *survey is relatively long and open,* due to the fact that we ask for information on your background, your projects and their impact, as well do we focus on ICT&ART in a EU context.

The survey should take minimum 15 min and maximum 30 minutes of your time. The login is IP sensitive, so can take the survey on different times. By closing your browser the data will be automatically saved, you don't need to log out in the end.

In all there are 34 questions to be answered, some of them open, other MC. The data will be used for mapping and analysis the ICT&ART context, thus the data will be kept within this study.

You can freely browse in the survey, going back and forward, adjusting answers.... all without losing the data.

If the survey would crash, this has to do with the browser setting. Don't worry, clicking again on the survey all data should be still in place. We would like to apologize in advance for any inconveniences.

Of course we would like your feedback to make this platform and survey better, feel free to contact us at feedback@ictartconnect.eu

General information

Name ……
Affiliation ……
Degree(s) ……
Place(s) of work ……
Place(s) of residency ……
Contacts (email, phone,...) ……

Interests

Describe your practice or interest in three sentences
……
……
……

Where did these interests come from? (multiple answers possible)

- primary/high school university
- high school
- art school
- DIY learning
- learning by practice/problem solution thinking cultural background
- technical background
- general interest
- by accident

What is your main motivation?

……
……
……

Projects

Did you ever participate in cooperative projects (in research or arts).
Yes / No

If so, which where these former projects (title, general information, website,...)

……
……
……
……
……

If so, which are the current projects (title, general information, website, ...)

……
……
……
……
……

Future projects (planned submitted or scheduled in the future)

……
……

Do you have a 'Utopic project'?

……

Perspectives on ICT&ART projects

Please describe one of the above that you consider was the most successful

……

Why was it successful?

……
……
……

How was the cooperation structured?

……

What were the project results?

……

Did the project achieve what you hoped for?

……

Did the project result in unintended outcomes? If so which ?

……

Did the project result in? (multiple answers possible)

- contextual output (creating meaning and context for society of further research)
- content output (form related, tangible output)
- impact output (change or transformation of society or further research)

Please describe one project of the above that you consider was the least successful

……

Why was it unsuccessful?

……
……
……

How was the cooperation structured?

……

What were there project results? (if any)

……
……
……

What do you think a good ICT&ART project should result in?

……
……
……
……
……

EU funding context

Are you acquainted with Horizon 2020 – the EU Framework Programme for Research and Innovation?
Yes / No

Are you acquainted with other EU funding programmes, such as the Creative Europe for the Cultural and Creative sectors?
Yes / No

If you responded positively to the 2 previous questions, is there a need for a specific line of funding for the sector of ICT&ART in the context of Research and Innovation (H2020)?
Yes / No

If yes, do you have any specific suggestions?
……

ICT ART

What are your ICT technical skills?
……
……
……
……

What are your conceptual skills?
……
……
……
……
……

What is your medium of expression?
……
……
……
……
……

Where would you position your work on crossing of ICT&ART when ICT would be 1 and ART would be 9?
1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9

Is your work process closer to science practice or art practice? Where would you position it when science would be 1 and art could be 9?
1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9

Do you consider yourself an… (multiple answers possible)
- artist
- researcher
- ICT'er
- scientist
- engineer
- artist as a researcher
- researcher working as an artist
- other

Does your work have an impact on other fields of expertise? If yes, which fields?
……
……
……

Network

What is the strength of your network focusing on ICT&ART and where would you position yourself in it?

…….

Who do you consider to be key players in that network?

…….
…….
…….

Are there enough opportunities to network, share views and opinions, disseminate your projects and vision on ICT&ART?

…….

What is your general vision of the actual role of the EU towards the field of ICT&ART?

…….

Who else should we interview or add to the database?

…….
…….
…….

Thank you for finishing the survey. By just closing the survey, your data will be recorded. You don't need to log out.

Any feedback on feedback@ictartconnect.eu is always welcome!

ANNEX II – Selected Success Stories

@Diversity.eu	https://www.at-diversity.eu/
Aalto University	http://www.aalto.fi/en/
Ableton Live	https://www.ableton.com/
Arduino	http://en.wikipedia.org/wiki/Arduino
Ars Electronica	http://www.aec.at/about/en/geschichte/
Ars Electronica Future Lab	http://www.aec.at/about/en/geschichte/
ART+COM	http://artcom.de/en/about/
ArtAbilitation	http://en.wikipedia.org/wiki/ArtAbilitation
Axoloti	http://axoloti.be/about/history/
Brighton Fuse	http://www.brightonfuse.com/
CREW	http://www.crewonline.org/
DevArt	https://devart.withgoogle.com/
DX7	http://homepages.abdn.ac.uk/mth192/pages/html/Chowning.html
Experiments in Art and Technology	http://en.wikipedia.org/wiki/Experiments_in_Art_and_Technology
Eyebeam	http://eyebeam.org/about
FAUST	http://en.wikipedia.org/wiki/FAUST_(programming_language)
Flickr	https://www.flickr.com/
Golan Levin (and collaborators)	http://www.flong.com/bio/en/
Google Lab Cultural Institute	https://www.google.com/culturalinstitute/home
Hack The Art World	http://hacktheartworld.com/index.html
Ideo	http://www.ideo.com/about/
IMAL	http://www.imal.org/en/page/about-imal
Interactivos?	http://medialab-prado.es/interactivos
IRCAM	http://www.ircam.fr/
ISADORA	http://troikatronix.com/isadora/about/
ITP	http://about.tisch.nyu.edu/object/itp_history.html
Kitchen Budapest	http://en.wikipedia.org/wiki/Kitchen_Budapest
LIA Software	http://en.wikipedia.org/wiki/Lia_%28artist%29
Listening Post	http://www.sciencemuseum.org.uk/smap/collection_index/mark_hansen_ben_rubin_listening_post.aspx
MediaLab Prado	http://medialab-prado.es/article/que_es
MIT Media Lab	http://www.media.mit.edu/about/mission-history
NESTA – Digital R&D fund for the Arts	http://www.nesta.org.uk/project/digital-rd-fund-arts
openFrameworks	http://openframeworks.cc/about/
Planetary Collegium	http://en.wikipedia.org/wiki/Planetary_Collegium#History
Predictive amplitude	http://en.wikipedia.org/wiki/Manfred_Clynes#Predictive_amplitude_shaping_in_music
Processing	https://processing.org/overview/
Pulsum Plantae	http://lessnullvoid.cc/pulsum/
Reactable	http://www.reactable.com/history/
RIXC	http://rixc.org/en/center/
School of Poetic Computation	http://sfpc.io/mission/
Science Gallery	https://dublin.sciencegallery.com/this_is_science_gallery
SKILLED ART	http://www.eurekanetwork.org/project/-/id/4982
SMARTLAB	http://smartlab-ie.com/
Soundcloud	https://soundcloud.com/
TEKS	http://teks.no/
Tenori-ON	http://en.wikipedia.org/wiki/Tenori-on
The Lab	http://telecomworld.itu.int/world-2014/innovation/
Transmediale	http://transmediale.de/content/history-transmediale
Waag Society	https://www.waag.org/en/organisation
Wiring	http://wiring.org.co/about.html
Wooden Mirror	http://www.smoothware.com/danny/
ZWERM	https://www.zwermgent.be/

ANNEX III – Testcase: Bozar Electronic Arts Festival & GLUON

Evaluation on the collaboration between the ICT & Art Connect Study and BOZAR.

The Center for Fine Arts is extremely positive about the collaboration with the different stakeholders of the ICT & ART Connect Study; Artshare and iMinds. Those collaborations stimulated reflections upon the role of the artist today and the way cultural institutions such as BOZAR should react to this. It also triggered interesting reflections upon the methodology of presenting results in the field of art & IICT and upon the necessity of a well-developed parallel programme. The collaboration with the stakeholders of the ICT & ART Connect Study brought new visitors to the BEAF festival and stimulated international networking opportunities. Because of its experiences with this study, the Center for Fine Arts is convinced it can contribute a lot to the future plans of DG Connect in the field of Art & ICT.

Reflection upon the role of artists and cultural institutions today.

The collaboration with the ICT & ART Connect Study stimulated a further reflection within the management of the Center For Fine Arts upon the definition of the artist in our contemporary society and its impact this on the role of cultural institutions and museums today. (cf. Introduction Speech Paul Dujardin, CEO-General CFA to the symposium). The unending possibilities of digital tools and the democratization of the Internet make the barrier to crossing borders between different disciplines much smaller. People from the worlds of science, culture or technology work with the same tools and encounter the same basic challenges. Moreover the Internet has augmented the contacts between them and information is spreading much faster through different parts of the world.

All this has changed the working methodologies of a younger generation of artists. Some artists still work alone and produce marvelous works of art, but others search for permanent collaborations and take up alternative goals in society. We could call them hybrid artists or social designers. They work as independent 'entrepreneurs' that perhaps establish multidisciplinary teams and move on the borders of different disciplines such as architecture, sociology or bio technology. They consider themselves artists as well as scientists or researchers. They love to experiment with new technologies and critically follow the latest developments in science and technology.

Because of this evolution the cultural institutions feel the necessity to adjust their policies and this is what the Center for Fine Arts is doing today with the BOZAR Electronic Arts Festival. It started in 2010 as an event for experimental music, added media arts to its program and evolved to a platform that also presents the results of collaborations between people from different fields. Because of its broad network in the field of arts, performance, architecture & design, the CFA can stimulate major representatives from different cultural fields to collaborate with researchers in the field of ICT.

Together with the research department iMinds BEAF presented the result of collaboration between the urbanist and artist Luc Deleu and researchers from the

different universities in Brussels and Flanders. Together they developed a system to organize the public domain on a global scale. An artist alone cannot manage this, he needs the enthusiasm and expertise of young computing specialists. And in collaboration with the ICT & ART Connect Study the Center for Fine Arts presented success stories that show how hybrid artists can also force disruptions in ICT technology and how this could have an impact in our economy or our society in general.

Reflection upon the methodology of presentation.

The collaboration with ICT & ART Connect Study also stimulated further reflections within the BEAF team upon the methodology of presenting the results of collaborations in the field of art & ICT. Today the programme of the festival mainly consists of an experimental music programme and the presentation (or rather integration) of media installations in the beautiful spaces of the Center for Fine Arts. For the first time the festival presented successful ongoing projects in the field of art & ICT. The presentation of the success stories did not focus on artistic merit, but on the possible impact of art processes in the creative industries. This stimulated a reflection upon 'what' and 'how' these stories should be presented. Many questions are still pending. For example: 'Does the festival present artworks that inspired (or could inspire) people from other fields or does it show the concrete industrial, applied and economic results of collaborations between artists and people from other disciplines?'.

During this edition the presentations of the success stories were mainly documentary and did not have an immediate impact on the public that expects to see art works. These presentations consisted of projections on exhibition walls. From within the Center For Fine Arts we think it would be better to present success stories in the form of lively presentations whereby the artists and researchers (or artist-researchers) present the results of their work. This in line with the presentations of the results of the Art & D programme organized by iMinds during the symposium. In collaboration with DG Connect and future partners the BEAF festival will further develop its parallel programme, which seems today the most appropriate way to promote the value of collaborations between artists and people from other fields within the context of the Center for Fine Arts.

Reaching new visitors & the creation networking possibilities

Through the collaboration with DG Connect and the stakeholders of the ICT & ART Connect study, the BOZAR Electronic Arts Festival succeeded in bringing together; representatives from the EU commission, policy makers, researchers, directors from institutions or organizations and media artists, with an interest in art and ICT. Those people visited the exhibitions in the Center for Fine Arts, attended the symposium and were introduced to the presentation of the success stories. In a professional, but in the same time enjoyable atmosphere, those people were able to establish new networks and to discuss past experiences and future collaborations. For the Center for Fine Arts it was in particular interesting to reach people from outside the field of culture and politics. Researchers, scientists, ICT experts and engineers are welcome new visitors to the festival. On the other hand, BEAF contributed to the success of the study. More than 3000 visitors, interested in the programme of experimental music, had the opportunity to discover the success stories that were selected by the ICT & ART Connect Study. The symposium has been attended by 150 people, mostly specialists from the field of ICT & art.

GLUON, a new initiative in Belgium.

Gluon is a platform that realizes projects on the crossing borders of media arts, technology and science. For the realization of its programme Gluon is supported by an ab initio network of Belgian research departments, cultural institutions, governments and enterprises. Gluon was founded during the ICT & Art Connect study, and this with the support of the CEO of the Flemish research department iMinds (Wim De Waele) and the director of the Center for Fine Arts in Brussels (Paul Dujardin).

Cities, cultural institutions, governments or private persons can launch an open call via the site of Gluon. This open call should formulate a challenge that needs the involvement of a multidisciplinary team for its solution, requires the creative input of an artist and stimulates experiments in the field of technology and science. A city could for example commission a multimedia installation for its public space or a company can invite a multidisciplinary team to develop a new and inspiring idea that relates to its products or services.

On the basis of this open call national and international artists, whether or not in dialogue with researchers, are invited to send exciting proposals online. These proposals will be reviewed by an independent jury. Once the best proposal is selected, Gluon will establish a multidisciplinary team that develops the ideas and translates them in prototypes or concrete realizations, this in collaboration with local or international experts and companies.

ANNEX IV – Report on online presence

During the last period the project's web presence was shaped towards the adjusted scope of the project. Moreover, the branding of the web platform was changed from 'ICT ART CONNECT' to the new 'STARTS' brand name, including an updated style. These updates were rolled out at the end of 2014.

Overview online presence

1. Interactive map
2. Community feature
3. Presentation of results of the study
4. Search
5. Import of existing databases
6. Merging of content of ict-art-connect.eu and ictartconnect.eu
7. New Science Technology and the Arts design

As established in the first reports the aim of the online presence was twofold. First to provide an overview of the different institutions and programmes that are available worldwide, focusing on ICT & ART, mapped as Points of interest (POI) on an interactive map of the world. Secondly to provide community features that would enable researchers in the field of ICT & ART to make use of and contribute to the data on the online platform.

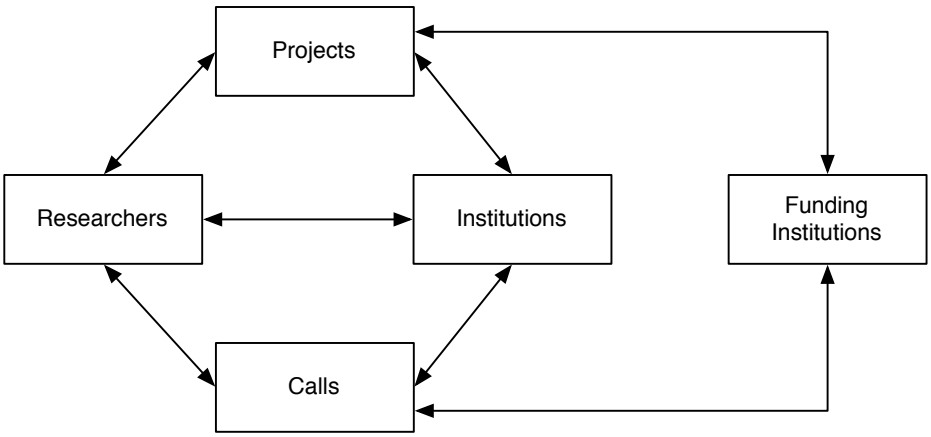
The platform is currently available via the url staging.ictartconnect.eu, but is ready for relocation to a final hosting solution at short notice, at which point staging.ictartconnect.eu will take the role of a so-called staging server, allowing us to test changes to the platform's feature set, before rolling them out to the 'live' site.

The design and development of the platform is following the good practice of agile development using a combination of iterative SCRUM cycles and the LEAN UX paradigm, creating a very short feedback loop between the development team and key stakeholders.

Information Architecture

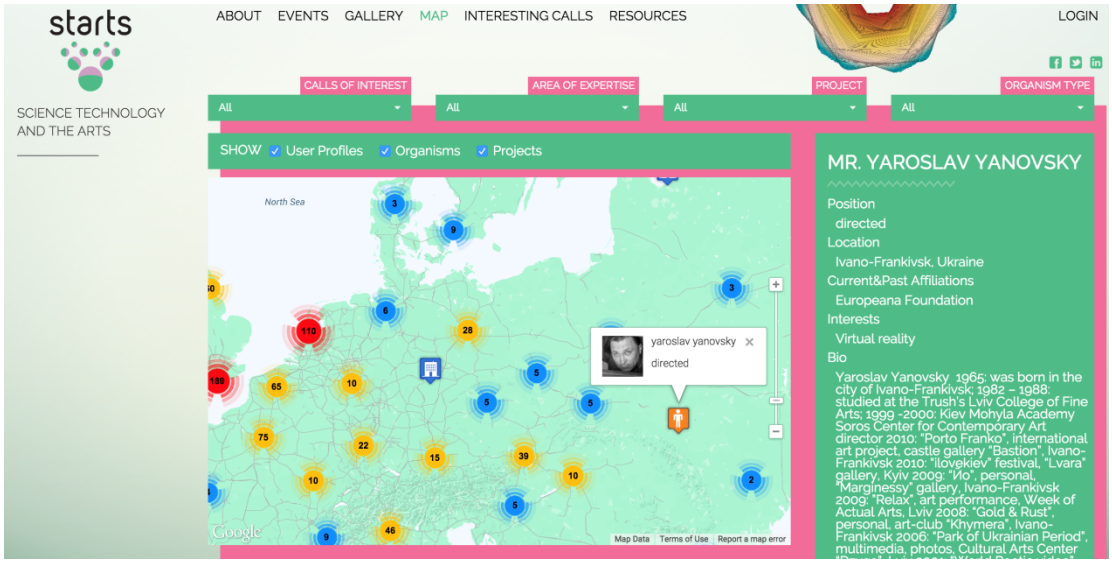
The platform's information architecture, from which all functionality is derived, consists of four major, interrelated objects: Researchers, Institutions, Calls and Projects. These are supplemented by a number of other support objects.

Capturing the interrelatedness is important, as it will allow us to better match ICT & ART researchers to useful content as well as visualize and make accessible the content in a useful way. Through creating filters on interests, locations and projects, users of the website will be able find common profiles or interesting projects to affiliate with. The interactivity is promoted by visualising the results of the study giving an overview of popular interest and profiles.



Each of the POI's contains a growing list of metadata. During the study the study-team was able to merge data from desk research, former projects and through consultations online in order to input a massive increasing amount of updates to data. Through the survey, the open calls and through emails participants were asked to share and update their data generating a representative frame of the ICT&ART eco-system. We are now in the process of linking this data to the best extent possible and making it accessible in such a way, so that it becomes useful as a tool to explore new areas for collaboration.

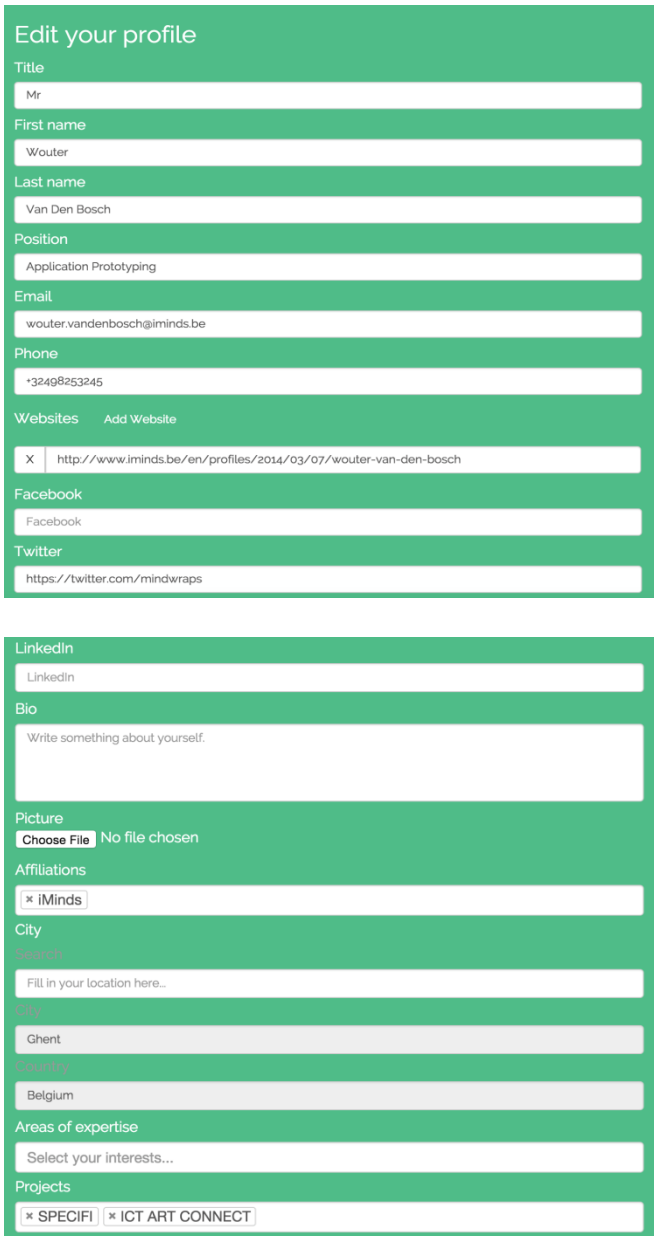
Where possible the data are geolocative, so that they can be visualized as points of interest on a map. The minimum metadata set is composed of a title, an address and a description, but is complemented by metadata, derived from task 3 of work package 1, in which the different institutions and programs are identified and analysed.



The online platform with a view on the interactive map: the numbers in circles represent multiple entries at the same location and split up into individual entries at lower zoom levels.

Researchers in the field of ICT & ART have an elaborate profile they can complete listing both personal contact details as well as institutions they are affiliated with as well as projects and interests. By doing so they connect to existing institutions and projects or provide the data themselves if they are not present in the

database. By asking researchers to search and indicate calls of interest to them via the 'Calls of Interest' section we can later connect them to other researchers, institutions or even past projects in this field that may spur new collaborations or exchange of lessons learned. The figures below show the editing page of a user's profile.



User profile editing page

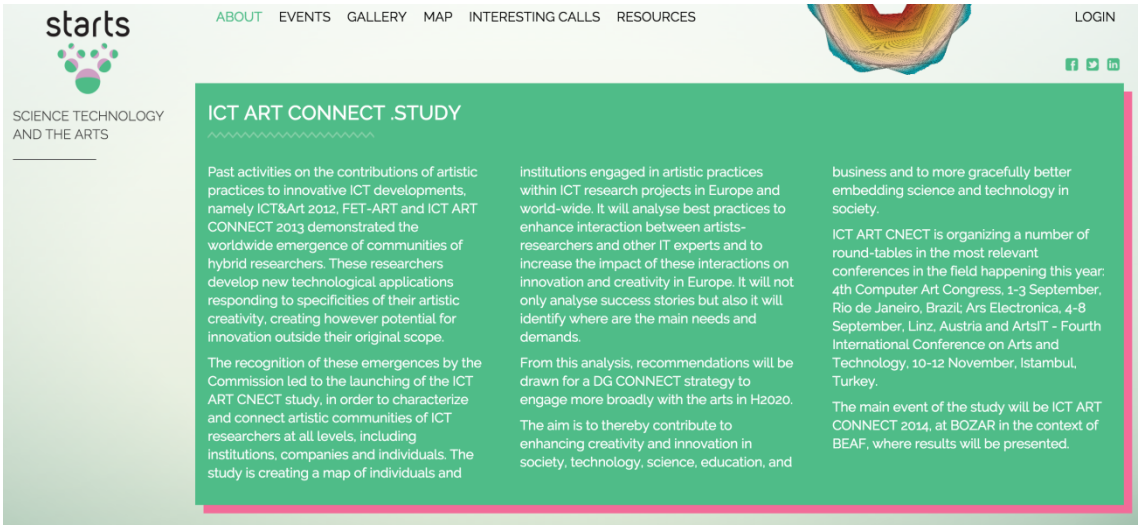
Furthermore the set of metadata as well as the access structures (the way through which the data can be navigated and searched) were iteratively updated based on discussion with relevant stakeholders.

An important update in terms of information architecture was a larger emphasis on the concept of projects within the platform. This was established during the advisory board meeting in Brussels, based on feedback of those present: mapping existing projects and capturing best practices or lessons learned from these would be highly usable for ICT & ART research community.

The technology

The information architecture is translated into an actual online platform using NodeJS technology powered by the KeyStoneJS framework. NodeJS is a JavaScript based alternative to PHP and is an up and coming web server system that has proven its worth as a highly performant technology driving both the web as mobile applications. KeyStoneJS can be seen as a Content Management System on top of NodeJS, allowing us to do more with less time. We chose NodeJS and KeyStoneJS due to their high performance as well as flexibility: we see the platform as continuing to grow well beyond the scope of this project and serving its data to other initiatives on demand. KeyStoneJS allows us to expose the data in the database as a website just as easily as exposing it as a public API to other platforms or even mobile apps.

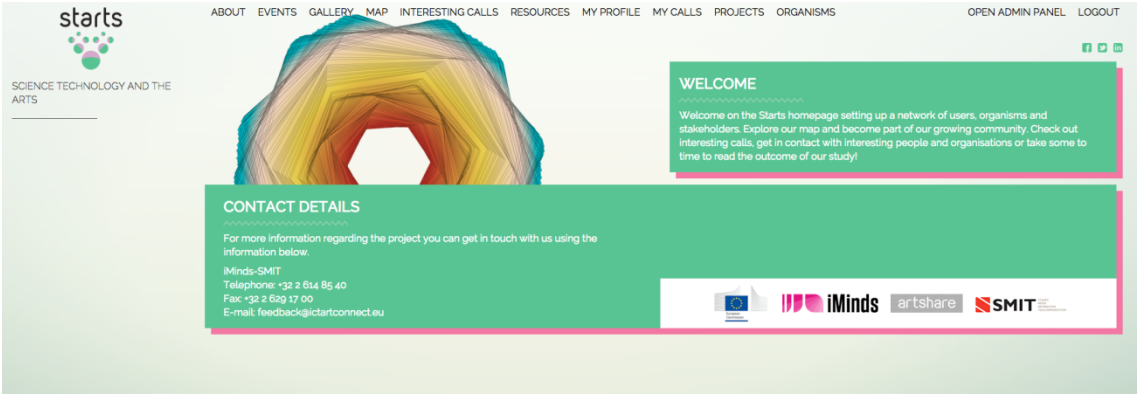
The result is an online platform with both a public as well as an administrative view. The platform can be visited as an anonymous user, an authenticated (community) user or an administrator. Content such as organisations or projects can be edited by all registered users in a wiki-like approach. Should the need arise to create a more formal editing workflow, this could always be implemented later.



The website from the point of view of an anonymous visitor

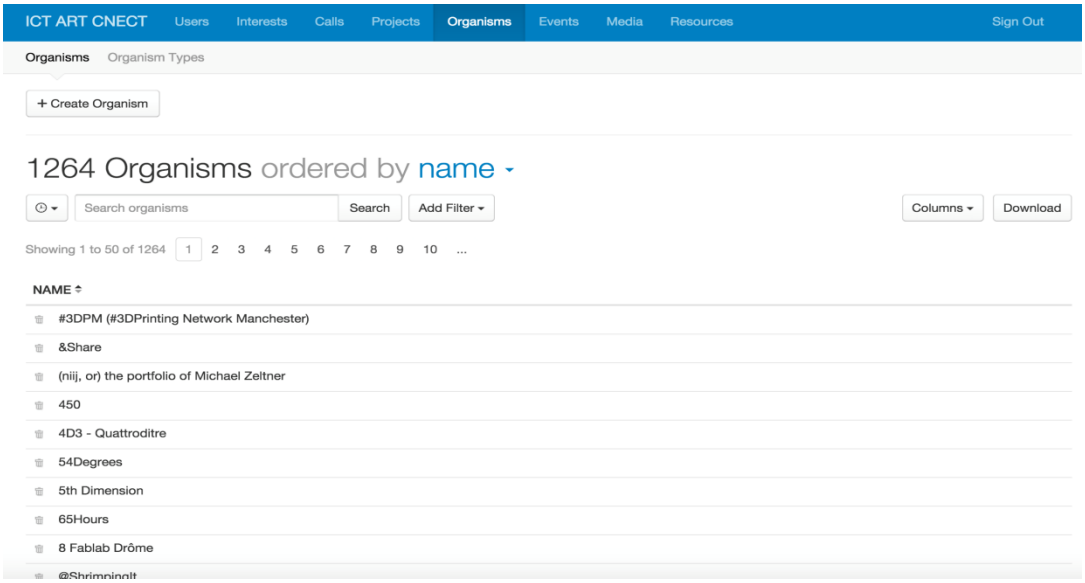
The platform serves as a basic informative website about the project, but also houses the online map as it grows.

Researchers in the field of ICT & ART are invited to register on the platform, complete their researcher profile and contribute projects and institutions to the database. Once authenticated the user interface exposes more functionality within the same environment.



The website through the eyes of an authenticated user

The administrative section allows users with the correct permissions to manage the data and manage the user registry.



View of the administrative section of the platform, focused on the Institutions section

To support today's growing number of devices through which one surfs the Internet, we have built the user interface employing a so-called *responsive* framework. This allows the user interface to adapt its layout and functionality dependent on the device and screen-size of the visitor. This way, users visiting the platform via a tablet or smartphone get a more optimized experience. This is done by making use of Twitter's Bootstrap responsive framework. Our aim is to provide a platform that is not the end of this project, but rather a framework for further expansion.

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