Technology, Citizens and Social Change in the Framework of European Research and Innovation Programmes: Towards a Paradigm Shift

Marta Arniani[✉]

Sigma Orionis, 1240 Route des Dolines, 06050 Valbonne, Sophia Antipolis, France
marta.arniani@sigma-orionis.com

Abstract. In this paper I present the paradigm shift occurred in recent years in the approach to technology development within the European Commission funded Research and Innovation frameworks. This new approach is attentive to social good, societal challenges and bottom-up users and stakeholders, but presents at the same time some limitations. By leveraging Sigma Orionis long-standing experience in European funded projects and highlighting the current trends, challenges and best practices, I identify some avenues for making this approach even more impactful in the coming years.

Keywords: Horizon 2020 · FP7 · European Commission · Social innovation · Communities · Collective Awareness Platforms for Sustainability and Social Innovation (CAPS) · Responsible Research and Innovation (RRI)

1 Introduction

In 1962, Thomas Kuhn released 'The structure of Scientific Revolutions' [1], which contained his most acknowledged contribution to human wisdom: the definition of scientific revolutions as paradigm shift, going against the idea in force until that moment of a cumulative progress of science. In Kuhn's view, progress and innovation happen in an alternation of 'calm' and 'revolutionary' phases (e.g. the shift from Newtonian mechanics to quantum physics), which correspond to great conceptual breakthroughs and lay the foundation for the following phase of 'business as usual'. If we look at European technology R&D agenda under Kuhn's lenses, it seems we are experiencing one of these settlement stages. In a moment where European institutions are vacillating under the threat of the economic crisis and citizens' declining trust, the European Commission Research and Innovation framework named Horizon 2020 (2014–2020) [2] follows up to its predecessor FP7 (2007–2013) and works towards some alternatives to the status quo.

Following the Lisbon European Council (2000) objective for Europe "to become the knowledge-based economy" [3], the focus has indeed progressively shifted from the development of technology for the sake of technology, to an inclusive approach engaging end-users and citizens in the definition of the technology itself and its purposes, completed by a novel attention to the implementation of technology solutions to societal

challenges. This orientation can be traced in Responsible Research and Innovation (RRI) and Citizen Science fields, in the CAPS (Collective Awareness Platforms for Sustainability and Social Innovation) programme [4], where R&D is for vocation at the service of societal challenges solutions and towards the common good, in the requirement of creating multidisciplinary working groups widespread across all calls, or in the hype around concepts such as open innovation, social innovation, innovation ecosystems.

By leveraging Sigma Orionis experience and active role in several FP7 or H2020 projects at the crossroads of technology, citizens and social changes (PARADISO, CAPS2020, CATALYST, RRI-ICT Forum, FET-ART, MusicBricks), I address in this paper the growing attention given to the development of technology at the service of social good in the framework of Europe's R&D agenda, producing a concise overview of its evolution (it would be impossible to cite here all the programmes and projects concerning the topic), current status and future challenges providing concrete examples from a selection of European funded-projects. I especially focus on the approach and methodologies with which end-users and society are becoming drivers and/or active parts of technology development.

2   ICT: A Societal Issue and Solution

Can Information and Communication Technologies (ICT) contribute to a "better world", characterised by more controlled economic and financial models, by more ambitious solutions to the environmental challenges, and a significant reduction of social inequality? This question, based on the vision of a desirable societal paradigm, was central to the PARADISO project (2007–2011) [5], involving the Club of Rome and Sigma Orionis. In 2009, the explosion of the economic crisis derailed all certitudes. PARADISO and its final reference document captured the spirit of the time by shifting the focus from technology being a value *per se* to a vision of technology being inseparable from its societal implications and motivations: the final recommendations of the project included 'encourage holistic multidisciplinary approaches', 'increase the involvement of users', 'promote values-driven programmes and projects'. Meanwhile, in May 2010, the European Union (EU) was launching the Digital Agenda for Europe [6] flagship initiative, aiming at "rebooting Europe's economy and helping Europe's citizens and businesses to get the most out of digital technologies". The initiative flags up the necessity of exploring the two-way interactions between technology and society, putting the human at the centre of the analysis, and exploring how the digital age can be a success factor not only for EU's competitiveness but also for its values. Today, we can find Responsible Research and Innovation as a cross-cutting issue in the EU Horizon 2020 programme: under this concept the EC defines an inclusive approach to Research & Innovation (R&I), aiming at better aligning both the process and outcomes of R&I with the values, needs, and expectations of the society, notably through reinforcing public engagement, open access, gender dimension, ethical issues, and (formal and informal science) education.

This whole shift is prepared by a broader call into question of Science and Society roles, prompted in the early 2000 by the European Commission's DG Research &

Innovation through its "Science and Society Action Plan" [7] and the working document "Science, Society and the Citizen in Europe" [3] encouraging a better connection between science and European citizens. In the same years, a parallel interest towards the role of technology in the everyday life of European citizens informed the approach to what we call today the Internet of Things (IoT). We have to go back to 2001, when the European Commission launched the Disappearing Computer initiative [8], to see a first attempt to study 'how information technology can be diffused into everyday objects and settings, and to see how this can lead to new ways of supporting and enhancing people's lives that go above and beyond what is possible with the computer today'.

Reading these tendencies with Kuhn's lenses, the beginning of the 21th century sees for EU ICT R&D frameworks the end of the dichotomy between technology, virtual reality, Internet on one side, and on the other, the so-called 'real world', the environment where humans and everyday activities take place. This shift is today far for being granted (the dichotomy between online and offline is still a fashionable one), but a seamless consideration of both aspects is where we are heading to, adjusting our vocabulary and approach (from consumers to prosumers, from top-down to co-creation), and taking into considerations new actors such as makers, hackers and DIY culture representatives.

One of the major manifestations of this shift is that ICT programmes highly focussed on social innovation and addressing grassroots communities and citizens are booming. It is the case of the CAPS one, launched in 2013 (the first dialogue about it took place at the PARADISO final conference). The first batch of projects funded covers and tackles, along with technology, a range of societal issues such as emissions reduction, CSR monitoring, urban accessibility, collective intelligence in online debates, decentralisation of platforms and e-infrastructures. One of these (the Coordination and Support Action Ia4Si), starting from the assumption that social transformations happen through cascades of changes, has created a classification system for such effects, with four main categories (social, economic, political and environmental), whose results will be made available soon [9].

CAPS success - even too much for a relatively small programme, with 193 proposals submitted at the first H2020 call against a budget available for around the 5 % of them - demonstrates the need for and the feasibility of this 'empowering' approach, which can be implemented in similar ways in other EC calls with a social innovation implication. Somehow CAPS 'hacked' the system without quitting it, which is even more remarkable. All CAPS projects and external stakeholders gathered together at CAPS2015 [10], the annual event about CAPS: launched in 2014, the event was a great occasion to see the results of the first round of CAPS projects so far, to cross-pollinate ideas and to involve new actors. Interestingly, despite the CAPS programme being still a novelty, for being just the second edition of the event there was already a generalised urge to go beyond enthusiasm and to share and learn actual best practices. This implies first of all a non-instrumental approach to communities, blurring the line between bottom-up and top-down in favour of a collaborative co-creation. Co-design, and design in general, emerged as important factors for the impact and effectiveness of such initiatives: we are finally talking about 'how' to reach common objectives together supported by technology instead of taking for granted a mechanical and tech-centric view of engagement.

This is most probably why topics such as democracy and collective intelligence where at the centre of the debate, alongside with the need to rethink citizens' sovereignty on their data and privacy, and to set up decentralised structures. This said, turning to communities cannot be the jack of all trades, as they are mostly based on enthusiasm and voluntary engagement, resulting often in immaturity towards their objectives and means to reach them. For the same reason, they can prove 'lazy' towards adopting new means, and prefer to work with known systems and platforms such as Facebook (despite fighting for freedom and privacy). On the other side, it is clear that there is no sense in working for communities without working WITH them. As debated in the framework of the CATALYST CAPS project [11] – focused on developing tools for improving the quality of online conversations and catching the potential of collective intelligence – understanding not only the demand, but also the offer, defining roles and shaping custom tests are central.

So far I mentioned mainly social-driven frameworks, but one should not forget that this collaborative logic applies to business and entrepreneurship as well. There is a broad part of European research that does not hit the ground and does not make it to market (and consequently to society) because all the effort is concentrated on the development and not on the exploitation. As highlighted by the Innovation Radar report [12], a quarter of already mature innovations are not being exploited yet: one of the main barriers to market is that the main focus is on technology aspects, too often at the expense of studying the demand and developing an exploitation strategy. Another interesting data issued by the report is that SMEs and small actors prove to be the most innovative people in the room (they deliver 41 % of innovations despite accounting for the 14 % of the total funding).

If real-world impact and exploitation are key issues lacking adequate approach, as much as new actors are engine for innovation but still far from being valued, can changing attitude towards them be a central component of our new paradigm? In this respect the CONNECT Advisory Forum (CAF) made a groundbreaking work [13], by suggesting to move from Technology Readiness Level (TRL, invented in the 80 s for NASA's rockets, not that applicable to mobile apps) to Market Adoption Readiness Level (MARL): "In addition to the technology readiness levels parameter, this model requires the assessment of three further value parameters: users (numbers of potential early adopters and values associated with feedback loops), data (potential quantity and value of data generated by the system and user interactions at each stage of the process) and the level of risk (assessment of benefits or adverse impacts of the technology on early adopters in various stages of the process)."

As part of our paradigm shift, frequent feedback loops with end-users have started to take over years of closed research in labs: a good example is provided by the #MusicBricks project [14], which is all about the hackathon 'day after'. Music technologies (including gesture sensors for music performance, real-time pitch detention, melody extraction) coming from the best European research centres are made available in the hackathons organised in the framework of events like the Music Hack Day and the Music Tech Fest: a rose of projects conceived during these events get further support (technical, financial and strategic) to make it to the market. It is a win-win situation for researchers - who get feedback from tomorrow's users (they have been seen 'hacking'

their own tools during hackathons to make them responsive to the need of the hackers), creatives who may end up starting a new business, and Europe, which desperately need to leverage its talents and resources. Despite of music technology not being directly related to social good, it is interesting to note that among the projects selected so far, many deal with accessibility and healthcare. High Note for instance is a hands-free wireless Midi controller instrument: it uses #MusicBricks technology to sense a range of different motions and mouth-controlled inputs to allow people with limited physical mobility or strength (or people who have their hands otherwise engaged) full participation in musical expression. Using the #MusicBricks R-IoT gesture sensor board, Dolphin is another of these examples, being an accessible gestural interface for controlling music selection & playback using head movements and head gestures. As a platform for interaction, the motion sensitive headphones can be used to track movement in space with respect to the audio played, as well as control that audio.

3   Way Forward: Beyond the End-User Chicken and Egg Situation

Open innovation, social innovation, innovation ecosystems… Innovation has never been so well defined. But to which extent can we frame innovation? Isn't defining something limiting its field of action? And how much is genuine the social aspect of the medal?

The risk here is that of gluing artificially citizens, DYI ambassadors and creatives to pre-determined projects in order to justify their usefulness, similarly to what is happening with revenue based companies hiding behind a sharing claim with accurate 'we-washing' [15]. The first point I would like to make is thus that involving 'unusual suspects' for the sake of doing so does not work: the answers to the questions "who needs to be engaged?" and "why?" must be made clear at the very beginning of any collaborative process. What I want to suggest here as way forward is to forget artificial results, and to focus on quality, dynamisms and inclusiveness. In fact, if the general mind set is starting to change, we are still far for claiming victory: as well explained in 2012 in the paper 'The E-(R)evolution will not be funded' [16], launching frameworks which take into account the social aspects of technology and set out to engage citizens does not imply an immediate effectiveness: the figures presented in the paper are quite demotivating (and in some cases astonishing: the cost of each users' contribution - post or petition's signature - was around 550 euros in the studied platforms). It is when classic concepts and approaches are no longer applicable that we experience the shift to a new paradigm.

Effectiveness and impact come at the cost of real involvement all along the whole process: there is an important difference for instance between calling an artist to illustrate the final results of a research projects, and involving her/him in the research itself. Surely one of the biggest challenges is about fine-tuning co-design: if technology - or at least technology that is supposed to have a social impact - in order to have a real impact is no longer to be developed in the ivory towers of research centres, then, to which extent must the social part be engaged? One of the key aspects of innovation is creating new needs, or at least anticipating them: if users are implied from the very beginning, it means real needs will be taken into account: this could turn out to be a two-faced feature.

The solution to this chicken and egg situation relies most probably in the separation of pure research (abstract, rigorous, anticipating needs), and research explicitly at the service of users and social good. In the second case, seed funds, regular feedback loops, real impact indicators and evaluation, co-creation methodologies, simplification of access barriers (mainly bureaucratic ones) is what we should experiment in the coming years in order to develop technology truly at the service of social good. Public authorities should focus on creating the framework for this to happen, without pre-determining the actors involved and the results. We are no longer talking about research, nor about R&D: we are just at the beginning of the next paradigm mixed playground, where old concepts will be replaced by a bouquet of new ones.

References

1. Kuhn, T.S.: The Structure of Scientific Revolutions. University of Chicago Press, Chicago (1962)
2. Horizon 2020, the EU framework programme for research and innovation. http://ec.europa.eu/programmes/horizon2020/
3. Commission working document: science, society and the citizen in Europe. European Commission (2000)
4. Collective awareness platforms for sustainability and social innovation. http://ec.europa.eu/digital-agenda/en/collective-awareness-platforms-sustainability-and-social-innovation
5. Paradiso Initiative. http://paradiso-fp7.eu/
6. Digital agenda for Europe. http://ec.europa.eu/digital-agenda/
7. Science and society - action plan. Luxembourg: Office for Official Publications of the European Communities (2002)
8. The disappearing computer initiative. http://www.disappearing-computer.eu/index.html
9. Ia4SI. http://ia4si.eu/
10. CAPS2020. http://caps2020.eu/
11. Fledderus, E., et al.: H2020 ICT R&D&I beyond 2015. CAF – CONNECT Advisory Forum (2014)
12. #MusicBricks project. http://musicbricks.net/
13. De Prato, G., Nepelski, D., Piroli, G.: Innovation radar: identifying innovations and innovators with high potential in ICT FP7, CIP & H2020 projects. Science and Policy Report, Joint Research Centre (2015)
14. Huang, L.S.: #WeWashing: when "Sharing" is renting and "Community" is a commodity, Huffington Post (2015). http://www.huffingtonpost.com/leesean-huang/wewashing-when-sharing-is_b_6879018.html
15. Prieto-Martín, P., de Marcos, L., Martínez, J.J.: The e- (R)evolution will not be funded: an interdisciplinary and critical analysis of the developments and troubles of EU-funded eParticipation. Eur. J. ePract. **15**, 62–89 (2012)
16. Catalyst project. http://catalyst-fp7.eu/