Collective Awareness Platforms: Engines for Sustainability and Ethics

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The world's wealth, as measured by GDP, has been steadily growing for the last 100 years or so. But today there is more and more evidence of crisis in our world, in all areas: finance, environment, society. The causes are related to the lack of sustainability of our current model for growth and development. Simply put, the natural resources of this planet (Fig. 1) cannot sustain a population of 7+ billion people, on the basis of current modes of living. Infinite and unsustainable growth (economic as well as demographic), which often has been sought to boost the power and near-term prosperity of nations, is now at the root of the multi-faceted crisis of our "knowledge society." Is there a way to turn this weakness back into an opportunity?

From a different perspective, technology breakthroughs have been key to achieving such terrific growth, and to attaining the present level of natural resource consumption. Can the future evolution of technology also contribute to a solution to this problem?

There is a need to move beyond purely technology-driven solutions to enable new organizational, social, and governance models. These are needed to face the current societal challenges and achieve sustainability and well-being. Business as usual is not a solution [1]: the current crisis will require innovative solutions, such as moving from closed R&D and innovation models to open and collaborative innovation that can unleash the power of

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collective intelligence, generating social awareness.

Scenarios for the Future

Recently, the EU funded a study from the Oxford Internet Institute, titled "Towards a Future Internet: Interrelations between Technological, Social and Economic aspects" [2]. This study identified four pervasive forces that will impact the future of the Internet:

- Conflicts between the vested interests of Internet stakeholders (network operators, service and content providers, governments, and users);
- Changing infrastructure and socio-technical context, increasingly dominated by commercial convenience rather than technical effectiveness;
- Governance and regulation, which can play a key role in preserving network neutrality to prevent abuse of dominant market power;
- User focus, which is becoming more and more essential to drive the design of Internet interfaces, applications, and accessibility.

In order to understand how the evolution of the Internet can be guided to better serve the needs of society, this study defined several scenarios of plausible future socio-economic conditions with differing needs, of which the most emblematic were "Commercial Big Brother" (where the Internet serves as a heavily commercialized platform), and "Power to the People" (or "Collective Awareness," where the Internet doubles as a forum for democracy and freedom, based on free production and exchange of knowledge). Interestingly, in most of the discussions conducted by the study the latter scenario was considered as the most desirable, yet the same gatherings also considered the first scenario as the most likely to happen.

These two scenarios are opposite in many respects, but especially on two particular dimensions (Fig. 2): the type of dominant network control (whether centralized, or distributed), and the main type of beneficiaries, whether competitive economic interests (which includes personal entertainment), or new social forms of collaboration (e.g., exchange or co-production of knowledge).

Clearly, these two scenarios are extreme paradigms, both of which contain elements that are already present in today's Internet, and that are likely to remain in the foreseeable future. The question however is if – and how- we can anticipate the evolution of these trends, and how to evaluate their implications for society, in both economic and ethical terms.

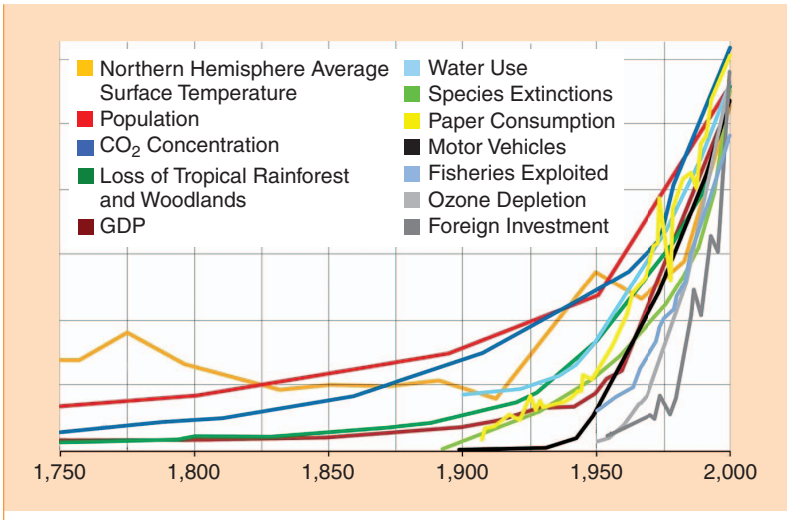

Fig. 1. Trends of natural resource consumption [57].

Internet Ethics

As a public body funding research activities, the European Commission is often confronted with challenges related to the assessment of ethical aspects associated with a particular proposal seeking public funding. Defining the exact meaning of "ethics" in a predominantly technology-driven field such as Information and Communications Technologies (ICT) is not an easy task [3]. An exhaustive pre-emptive analysis of all the potential ethical aspects of emerging technologies inevitably would be affected by subjective bias; in any case such an analysis is practically impossible because of the pace of technological progress.

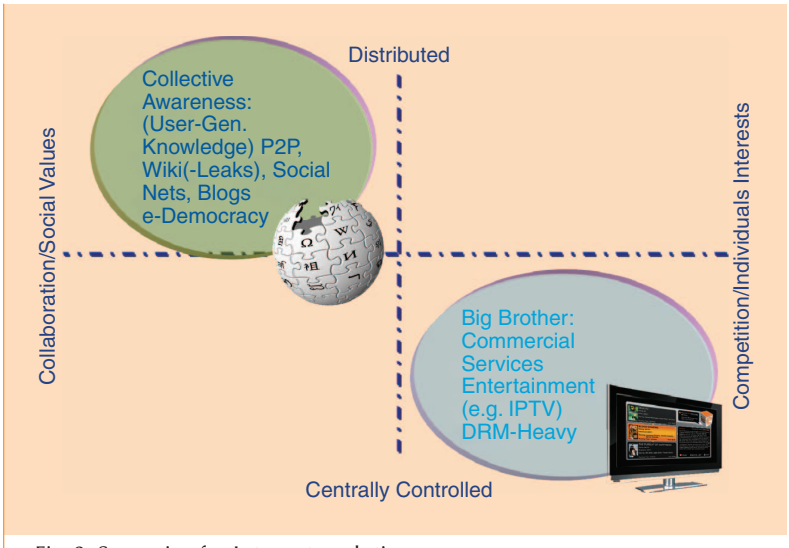

Fig. 2. Scenarios for Internet evolution.

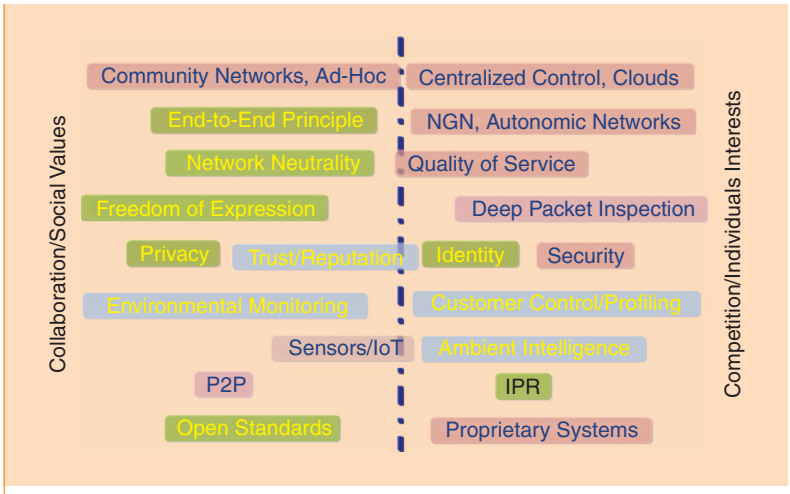

Fig. 3. Multidisciplinary elements of an ethical debate on future Internet.

For this reason, the European Commission's research programs require that a detailed ethics review is performed only in cases that "raise ethical issues." This mechanism relies heavily on bio-medical ethics, and focuses essentially on the potential risks of emerging technologies, such as a case of invasive interaction of ICT with the human body, or of a privacy violation. Clearly, such an ethics review is structurally unable to address a number of technological, application, or policy aspects of research that can be clearly identified as having far-reaching ethical impacts, and which would require a broader societal debate [4].

Such a societal debate also would allow going beyond the "risk-screening" approach and seizing opportunities for promoting socially useful ICT research that can have an impact on social aspects such as inclusion, access to knowledge, competition, and social cohesion. This debate should take place at all stages, affecting the definition of research priorities, regulatory actions, and the technical work of industries and researchers. It is probably at the stage of research proposals' selection that this debate can be particularly effective. In this sense, ethics should be considered as a transcendent dimension, key for both criteria that are currently used to prioritize research proposals (scientific excellence and socio-economic impact).

Fig. 3 lists a number of emerging technologies, applications, and policy aspects that can be linked to ethical aspects. The ethical debate on these topics is only nascent at this stage, so this picture is not meant to represent a final assessment, but rather a basis for nurturing a debate that should probably grow, in order to capture multiple perspectives, and include all concerned stakeholders.

This is also in line with several initiatives worldwide that are putting forward the concept of "corporate social responsibility," a process whereby companies integrate social, environmental, and ethical issues into their business operations and strategy in close interaction with their stakeholders, going beyond the requirements of applicable legislation and collective agreements, and creating benefits for all stakeholders.

In a phrase, we don't need to "do ethics" as an aloof elite action, but we do need to have "connected ethics" for a "connected world."

Network Effect: Mobilizing the Collective Intelligence for the Public Good

The "network effect" in economics or business networks, where the value of a product or service is dependent on the number of others using it. Therefore, each new user added to the network also increases the value of the network for all other users. This also applies to the value of the knowledge which is put into the network by the users, and especially to the number of new connections between different users, which grows as fast as the square of the number of users.

In Internet-based networks, the unprecedented number and density of connections between users creates a deluge of data. This offers huge and vastly untapped opportunities for the emergence of new forms of large-scale collaboration. The Web becomes the architecture for a new kind of collective intelligence in which humans are components of a larger intelligent system and their collective behaviors are able to generate rapid and widespread changes.

Unfortunately, as the number of users grows, the coordination of this type of cooperative effort becomes increasingly difficult and complex. For this reason, the number of people involved means that the most effective coordination mechanisms are those that are fully distributed, possibly based on spontaneous processes emerging from the "natural selection" of different possibilities. As a consequence, the resulting cooperation structures and the shape of aggregated knowledge are difficult to predict with formal theories (even with game theory) since they are rather "emergent" properties of the system, whose understanding may more reliably be based on empirical observation.

Collective intelligence [5] and the type of cooperative behaviors emerging from such networks is a hot research topic at the moment. Research seeks to discover if and how collective intelligence is at all superior to that of individuals, the ways it will evolve, and possibly how to favor its optimal growth. Collective intelligence is often related to the concept of crowdsourcing as a way of obtaining information, which also presents several unresolved issues,

such as determining the quality of data, how to manage and "curate" communities [6], and whether and how to select participants.

Connected Communities

Many discussions on collective intelligence fail to generate real "wisdom" as they tend to remain confined to theoretical considerations of virtual systems connecting humans and machines, often ignoring the connections to real world problems and real social communities and institutions. In line with what Rolf Pfeifer describes on how the body shapes the way we think [7], we would postulate that the needs and constraints of real communities (seen as the "embodiment" of networks) would shape the way collective intelligence evolves, and its functions.

When virtual networks, built in cyberspace, engage people belonging to a same community (not necessarily geographical), have consequences for organizational aspects of the real world, their impact may go beyond any expectation. They can influence elections, affect citizens' preferences, and even spark revolutions. The real challenge is creating collective awareness and action, going beyond the things that ICT is already fairly good at doing to more complex aspects of social and collective intelligence. The question is how to integrate and align the strategy with non-technology elements, such as social relationships, institutions, and social norms. Those are where the big impact will be. It is therefore crucial to avoid the frequent error of technology design and forecast of underrating human and relational aspects of change.

This may explain why the most successful Internet application, Facebook, is not as advanced as less-successful platforms such as Second Life (SL). The answer my be in the fact that SL lacks connection to real life context and real social communities (in spite of recent attempts in such a direction [8]). For most users, SL is used as a means for abstracting from social reality to live in a dream. In this author's view, this is a missed opportunity, as SL could instead be about a second social life in which we would like to live, a life free not only from physical constraints but also from preconceptions, where we have a possibility to cooperate and do some good for society and for ourselves. But, since generally there is no connection with reality, this opportunity is lost, and users fall back to their individualistic dreams.

Facebook is instead all about grasping social reality, or even better: it is often about the delusion of reality. In the same way that fiction and telenovelas represent a world realistic in every detail, but inaccessible for most of us, Facebook is about a mostly imaginary network of relations. On Facebook people have hundreds of friends, and all friends are real, but the interactions are often represented in a very simplified manner without exposing rich socio-cultural contexts, the complexity of human interactions and affective relations, and the limitations of our own social brain [9].

Referring to our previous dichotomy between Internet directions that contribute more to the cooperative or competitive components of human nature, one may wonder whether Facebook-style social networks actually expand our social world, enabling more cooperation, or if these networks instead restrict our social world and cooperation, limiting interactions to our "friends" (making "I don't care" of all the rest of the world).

Despite the latest advances in digital technologies and social networking platforms, we are still living in a world dominated by the old mass media paradigm, where information is controlled by few powerful actors that can decide what gets produced, broadcast, and distributed to a mass audience. However, the diffusion of the Internet, access to knowledge, and peer to peer social production have transformed the way in which people create, share, and distribute knowledge. It is now the right time to go beyond so called "virtual reality" or "cyberspace," to establish a direct connection with the social contexts and the material environment, thus empowering people to change their behaviors and enhance their lifestyles.

Is This What We Need?

The world is changing. Traditional jobs and economic models cannot ignore the digital networked economy. In the same way that "digital" replaced "analogue" almost everywhere, network meshes and hyperlinks are replacing linear and hierarchical relationships. Digital natives all over the world (in industrialized as well as in emerging countries) are critically dependent on the Internet, not just from a physical or economical point of view, but also from sociological and even psychological perspectives.

However, contrary to the trend of natural resources, which become more scarce as human population of the planet increases, the richness of Internet networks gets bigger and bigger as the number of users increases. The networked intelligence of people is the most powerful force that we have at hand to solve problems of any kind, such as those mentioned in the introduction. But harnessing networked intelligence in the right manner is not evident, because this is the first time in human history that we are given the opportunity to connect with each other by the billions.

Self-organization is a practice that is well known in nature. Molecules and insects have faced such survivability tests long ago. For humans, effective self-organization at planetary scale, given the critical constraints we are now facing, is critically dependent on the availability and appropriate organization of communication networks, which

can then become the backbone of new democratic governance models. Open platforms and the management of personal and social data, together with their open availability ("open data"), are key to this vision.

Collective Awareness Platforms

In current Internet ecosystems, three new phenomena have emerged having the ability to involve billions of users, with increased complexity and value. These phenomena provide new approaches for self-organization of human relations, knowledge, and information from the surrounding environment, allowing increased awareness and participation of individuals in collective decision making.

Social networking is perhaps the most popular and well-known of these phenomena: the biggest social network is approaching 1 billion users, and maintains a staggering valuation of 50 billion USD on Wall Street. But there are other models for social networks: Facebook is closed and centrally owned, whereas alternative distributed approaches can allow users to retain full control over their data, while at the same time allowing additional applications to flourish in an open manner [10].

Wikipedia is a model for distributed production of knowledge. With all its limitations, several studies found its accuracy very close to classical encyclopedias [11]. But Wikipedia is struggling to survive, and its governance models are also continuously put under discussion and redefined, in order to further improve its trustworthiness [12]–[13].

The third trend is perhaps even less apparent, but it is inexorably penetrating our everyday lives: the Internet of Things (IoT), electronic tags embedded in every item we buy or wear or live in, supporting commerce, maintenance, and operation of countless systems, and offering the means to create a greater pervasive awareness of our surrounding world. IoT brings the promise of providing humans with enhanced sensory capabilities, as well as serious risks to our privacy, depending on the implementation approach that is chosen.

Is there a Facebook after Facebook? It would be strange to think that the richness of the possible connections between billions of people remains limited to organizing our small social lives, without experimenting with new concepts and new forms of the emerging "hyper-connected humanity."

The same way that the current technological scenario is the result of a convergence of trends that 10 years ago seemed clearly separate (TV for entertainment, Internet for email, telecoms for telephony), the next step could be based on a blend of the three concepts mentioned above: social networks, cooperative production of knowledge, direct contact with the environment. All this is already altering our conscience, creating extended levels of collective awareness, both of relevant knowledge and of other people's actions. This increased awareness will then be the basis for better actions, at the individual and collective level, in order to satisfy societal, environmental, and other sustainability constraints.

Collective Awareness Platforms for Sustainability and Social Innovation

This is the concept that we have defined and publicly discussed [1], [14] and eventually translated in an initiative that is part of the "ICT for Societal Challenges" pillar of the European Digital Agenda [15].

These "collective awareness platforms" [16] are defined as ICT systems leveraging the network effect (or the "collective intelligence") for gathering and making use of open data, by combining social media, distributed knowledge creation, and IoT. They are expected to support environmentally aware, grassroots processes and practices to share knowledge; to achieve changes in lifestyle [17], production and consumption patterns; and to set up more participatory democratic processes. The ultimate goal is to foster a more sustainable future based on a low-carbon, beyond GDP economy, and a resilient, cooperative democratic community.

What Can They Do?

We are already seeing many examples of ideas, projects, or initiatives based on this convergence, which address societal problems exploiting the network effect.

Some solutions exploit the peer pressure from social networks as a tool to drive more sustainable behaviors, consumer patterns, and lifestyles say for energy, environment, or health. As an example, energy smart meters can have a significant impact on energy reduction thanks to increased individual awareness of the adequacy of one's own lifestyle [18]. But this impact can become even larger if customized advice and individual habits are shared and compared over social networks (as is done for food in the app "The Eatery"). This may also be the basis for creating "virtual communities for social change" [19], [20].

Collective awareness platforms can also support more efficient and worldwide-scale collaborative consumption, which is a key element for a low-carbon economy, making lending, exchange (also of knowledge or energy), swapping, and bartering operable at scale, across geographic boundaries [21]–[23].

An important field of application is getting facts or evidence from citizens and sensors, to enable better decision making (at personal or institutional levels) and increase resilience, for instance in transport [24], [25]. Some projects aim at achieving an "objective," near real-time and global awareness of environmental conditions, leveraging on personal mobile devices used as discovery tools [26]–[29]. These applications are in line with

the emerging concept of "citizen science," where ICT-empowered citizens actively contribute to scientific objectives, even without any in-depth scientific knowledge.

Collective awareness of environmental and social situations can also be used to drive better policies or to create new models for economy, society, and democracy [30]–[34]. Eventually, this extended awareness can also be a tool to support experimentation and implementation of new social and economic models [35] (e.g., social currencies based on social reputation, distributed P2P finance, microfinancing, etc.). Moreover, such distributed platforms could allow building a "Wikipedia of statistics," reconciling data from official and unofficial sources, increasing citizen's confidence and trust in statistics, forecasts, simulations, and scenarios [36].

Collective awareness platforms also will enable the possibility of feeding data, contributed by distributed human and environmental sources, into complex integrated ecological, social, and economic models including feedback loops, thus bringing them to the level of sophistication of weather and climate modeling. Such global simulations and statistics could lead to more accurate predictions of social, economic, or environmental trends [37].

Another broad range of applications is the development of alternative collaborative approaches to problem solving, supporting eco-conscious and democratic Smart Cities. Collective awareness can improve public services, urban environments, democracy, and the Internet itself, exploiting open data, crowdsourcing [38], [39], or serious gaming [40]. Governmental organizations are already launching frameworks to stimulate this type of civic participation to unleash talents in society [41]–[44].

Grassroots Ecosystems

Given the variety of size and scope of these examples, do we need a top-down framing of the different initiatives, or should we "let a thousand flowers bloom"? It is clear that no "one size fits all" solution can be found to manage the complexity of Internet-enabled human interactions. This provides a strong argument in favor of a bottom-up approach to the development of such platforms, open to new approaches and new stakeholders.

Another argument in favor of a grassroots approach is the need for authenticity, as an essential feature for such platforms to be broadly adopted and serve as an effective support to a sustainable society. We look forward to the flourishing of bottom-up ideas that are not primarily commercially-driven or central-government determined; at the same time, we expect that these new ideas will eventually lead to new business models and to new forms of social innovation, by proposing and demonstrating new organizational models.

Technology Needs

For most of the examples mentioned above, the solutions do not need very advanced technology developments, but only a sensible and transparent integration of existing technologies. However, as we envisage more powerful and complex ideas, integrating data obtained from sensors and humans, and using them as a basis for personal awareness and real-time decision-making systems, the need for specific technology developments increases. These may cover different areas, depending on the type of ideas and intended applications, for instance the interfaces with sensors and integration with IoT, or the management of the open data gathered though such interfaces.

Usability is also a key concern, due to the additional complexity resulting from the integration of different systems/networks, in order to guarantee a high degree of societal inclusion. Inclusion is indeed a key concern, which can be seen from multiple perspectives: granting openness for developers (by embracing open source and open hardware), lowering entry barriers for the users (e.g., by mandating use of free software), and enabling unrestricted access to communication facilities (e.g., through opportunistic or community networks).

Coordination

In a general sense, the main objective of this initiative is to embed technology in political and social processes that will generate real commitment and effort, by engaging citizens and society at large. This requires holistic collaboration encompassing all the different social and technical facets of the problem, in a distributed but loosely coordinated manner. Open coordination mechanisms can ensure an effective synergy between genuine bottom-up initiatives, without hindering flexibility and independence.

A light "hands-off" coordination of this multitude of emerging approaches should allow, in the first place, distilling best practices which can then serve to inform future developments. It may also help identify and involve the most relevant stakeholders who can act as credible "agents of change" and allow reaching a broad uptake of societal innovation. Coordination will also help creating synergies and building the critical mass needed for engaging citizens at large and achieving a noticeable effect on sustainability issues.

Regulation and Policy

A broad citizens' involvement, as envisaged in this initiative, also inevitably brings up aspects of regulation and policy.

In a first place, we need to broaden the societal debate about the ethical aspects of societal sustainability, and in particular on the fundamental rights of citizens resulting from the digital transition, in terms of quality guarantees from collective systems. In our vision, citizens will increasingly rely on collective systems for

everyday decision-making, which may include processes and transactions having life-threatening consequences. Is there a need to ensure a minimum level of quality guarantees on the information and content that are the basis of the underlying social platforms? Or will citizens, and society in general, autonomously weed out the inadequate or possibly manipulative actions?

Moreover, social networks, the Internet of Things, and collaborative knowledge production tools may be strongly affected by regulatory and policy activities on privacy and identity [45], open data, network neutrality, competitiveness, copyright, etc. Having a coordinated approach to these aspects is essential in order to be able to suggest sustainable approaches based on collective awareness. The above transformations imply new rules of the game agreed through democratic public debate and process.

Self- and Co-Regulation, Governance

Instead of just a heavy top-down approach to regulations, we look forward to a "co-regulation" of science and society, implying close involvement of citizens and civil society in the development of new Internet technologies. The platforms for collective awareness that we envision are mostly an afterthought of technological research that has had different priorities. As such, the platforms are critically dependent on the evolution of policy and technological foundations and open architectures which have been chosen. In the future, we need to see social and ethical impacts as the main drivers of technological development.

Ultimately, these platforms can contribute to the emergence of new forms of "self-regulation" based on individual contextual awareness of global social constraints. If we do not properly address the new regulatory issues [46], such as data protection, open standards, and regulation of Cloud computing, the future Internet will suffer from a lack of trust caused by users' and businesses' concerns about the security and privacy of the current technological infrastructure. Unless governance is holistically addressed though a democratic multistakeholder model, the increased level of vulnerability will affect both consumers and public and private organizations, with a damaging effect on the generation, take-up, and diffusion of innovation, risking having Europe fall behind in innovation [47].

Are We Sure?

No. We are in uncharted territory, nothing is sure until we touch it by hand; mirages, optical illusions and delusions can and do happen very frequently. There are only two tools in our hands to validate the concept: on one side, pursuing a theoretical understanding of these approaches, taking into account all the different multidisciplinary perspectives which are relevant, from "hard" and "soft" sciences. On the other side, as an empirical support to this emerging science of the Internet and society, we need more real-life experiments, more evidence to proceed by trial and error in developing sound theories and innovation practices, more opportunities to observe these strange beasts that are emerging in todays' Internet, as Darwin was observing Iguanas in the Galapagos.

Double-Pronged Approach

This corresponds to the methodology which has been chosen for the definition of the first call for proposals on collective awareness platforms, which has been published in July 2012 as objective 5.5 of [48], with a deadline set at January 15, 2013.

On one side, we want to support new experiences, pilots, and prototypes, harnessing the wealth of data and experience coming from citizens and their living environment. We expect pilots in any possible area related to sustainability, intended as a broad systemic and not "merely" in an ecological sense, such as citizen empowerment, direct democratic organization of action, sustainable lifestyles, and collaborative management of common goods.

On another side, we want to promote an integrated and coordinated approach to the multidisciplinary research that underpins key concepts of collective awareness creation, such as new value creation models, motivation and incentive mechanisms for online collaboration, and drivers of sustainable collective behaviors. We aim also to define ethics of collective awareness, including for instance how to make sure that contributions to the "collective intelligence" are made by "competent" people [6], or how best to structure networking in order to minimize risks of capture and manipulation.

This will also exploit synergies with the recently launched initiative on Internet Science [49] and the follow-up projects expected under objective 1.7b of [48], focused on multidisciplinary issues such as privacy, network neutrality, e-identity, and reputation mechanisms.

Open Seeds

Openness, in all respects, is a fundamental requirement for socially-oriented realizations. The development and adoption of open standards, free software, open hardware platforms and especially open data infrastructures are essential for unleashing the creativity of young and emerging entrepreneurs, developers communities, and designers [50]–[54].

For instance, new decentralized infrastructures for the Internet [55] can ensure that unhindered access and use of the Internet, especially in times of socio-political upheaval and authoritarian regimes, can be preserved. This can effectively empower citizens and democratic participation, in line with the recent "No disconnection Strategy," part of the Action Plan on the Southern Mediterranean adopted by the European Commission and the EU High Representative for Foreign Affairs

and Security policy, which is under the responsibility of Vice-President Neelie Kroes, EU Commissioner for the Digital Agenda [56].

The above mentioned call on collective awareness platforms will include a new mechanism for nurturing this openness and stimulating innovative approaches, by providing seed money for bottom-up social innovation initiatives, based on crowdsourcing and collective intelligence, carried out by web innovators, research teams, communities and entrepreneurs, students, and "geeks." The selection of the winners of such "contests" will be done through a combination of excellence evaluation and crowd funding mechanisms, in order to gather important inputs from all layers of society.

Fig. 4 depicts all the different components of the present calls related to Collective Awareness (closing on January, 15, 2013).

Meeting Sustainability Goals

Major Internet players and telecom operators are promoting, albeit to different extents, technological developments that contribute more to the competitive/commercial dimension than to the collaborative one. Progress in the competitive/commercial direction requires constant increases in quantity, which cannot be indefinite, whereas qualitative increases can.

Sustainability will become more and more a crucial concern in the coming years, but it is not evident that these players are willing, well equipped, or even credible enough to contribute honestly and authentically to achieving sustainability goals. The same way that Google or Facebook were garage companies just a few years ago, new ideas can emerge and fill this gap, with new models that perhaps may foster different sustainability and growth models. People have a role to play and, with a little help from technology, will be able to develop sustainable models of lifestyle, new collaborative production and consumption patterns and more participatory democratic processes.

A crucial success factor for this area is driving holistic collaboration encompassing all the different social and technical facets of the problem. It is a complex process, where emerging best practices would show how to embed technology in political and social processes that generate real commitment and effort. Platforms for collective awareness can play a critical role in increasing sustainability at multiple levels, but at the same time involve challenges of considerable size. Challenges include ethical, juridical and social issues, disciplines necessary for the platforms' development, and the critical mass that is needed to achieve a measurable impact.

For policy-makers, this complex and bold approach has to be approached carefully and modestly. A modest process is needed because such networks grow spontaneously rather than from governmental fiat. Care is needed because such networks can only grow in legitimacy if they grow subject to society's fundamental requirements of good governance. But neither the size of the challenges nor their complexity should be an excuse for inaction.

The huge and urgent challenges at stake have to do with much more than technological development or economic progress. We need to improve health, energy, ecosystem, public services, food, development, future civic infrastructures, inclusion, and empowerment for the poor. We are committed to embrace this approach as a possible means to have the impact of ICT evolve from fancy gadgets to tangible changes of lifestyles and organizational structures towards sustainability.

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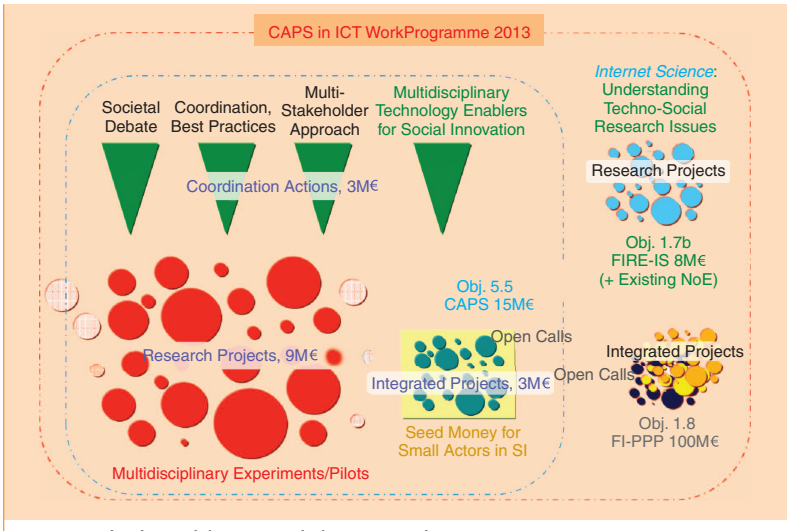

Fig. 4. The broad framework for research on CAPS.

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