Philippe GALIAY,* G. LAROCHE, L. PAULA

SOCIO-EPISTEMIC NETWORKS AND HUMAN BRAINS META-NETWORK: CAPITAL'S ULTIMATE AVATARS IN THE NEW SOCIETY?

Abstract: The new society will face many economic, social and environmental 'singularities' (e. g. in terms of economic growth, population, energy, or biodiversity) that will have to be dealt with without societal disruption. In this new society largely based on scientific knowledge, wealth creation will stem from 'socio-epistemic capital' accumulated by 'socio-epistemic networks'. The present trend towards Responsible Research and Innovation, supported by the European Commission under Horizon 2020 (its Framework Programme for Research and Innovation for 2014–2020), will help prepare the ground for these future 'socio-epistemic networks' and the smooth resolution of societal challenges.

Key words: *Knowledge society, socio-epistemic networks, socio-epistemic capital, Responsible Research and Innovation, societal challenges*

INTRODUCTION

One can only agree on the fact that "human society is currently undergoing changes of a nature unprecedented in both magnitude and intensity" [1]. Indeed, the very magnitude and intensity of these changes do pose real challenges to decision makers of all types, from public authorities adapting governance frameworks, to private decision makers investing for the future of their companies or launching protest campaigns, as well as to individual citizens expressing themselves regarding their own future. However, the perception of the nature (i. e. beneficial or not) and speed (i. e. too fast or too slow) of these changes varies greatly among individuals in society.

The 19th century French novelist and journalist Emile de Girardin is famous for a saying about government: "Governing is foreseeing ". Indeed, in the present turbulent times, foreseeing, forecasting, anticipating are more than ever necessary in or-

* DG Research and Innovation, European Commission

der to take today the 'right decisions' preparing the world of tomorrow. 'Foresighters' of all kinds should answer – at least – the following questions:

What will be important in the new society? What kind of policies do we need to initiate today for giving as a legacy to our children a society that we would like to be more democratic, inclusive, sustainable and… human? What kind of decisions are crucial today with a view to anticipating the coming changes largely (but not only) spurred by science and technologies?

These questions can only be answered by rising above day-to-day concerns, climbing on top of an accumulated body of knowledge, produced *inter alia* by comparative analysis at European level, in order to catch a glimpse beyond our current time and knowledge horizons.

The present paper will start from the assumption that wealth creation (and therefore capital) will be as central in the new society as it is today and that the wealth creation process will be based on 'socio-epistemic capital', i. e.:

1. It will underline first how the notion of capital has been evolving along time up to now, and how it is likely to appear in "a different type of civilization based mainly on knowledge, information, communication and most importantly – mobility" [1];
2. Consequently, dwelling on the notions of 'networks' and 'dialogue', it will argue that in order to cope with future challenges, "including political and economic change, energy concerns, natural resources, food supply, health, individual quality of life, and many more" [1], current policies should promote 'socio-epistemic networks';
3. Finally it will present the concept of 'Responsible Research and Innovation' (RRI), a feature of Horizon 2020 [2] (the new Community Framework Programme for Research and Innovation that the European Commission will implement from 2014 up to 2020), and the reasons why RRI can prepare Research and Innovation (R&I) to the new society.

1. THE EVOLVING CONCEPT OF CAPITAL

In ancient Greece Aristotle was already wondering how wealth was accumulated and if such accumulation was more legitimate and beneficial for the community, in private or public hands. Discussion went on throughout the middle ages, in the classical period, industrial revolution, until the modern time and up to now. At the same time, it spread all over the world and blossomed into hundreds of schools of thoughts, although a select few are more recognised than others and give some points of reference as beacons in the ocean of economic theories (Thomas d'Acquin, Adam Smith, Thomas Malthus, Karl Marx, Nikolai Kondratiev, Max Weber, John Maynard Keynes, Robert Lucas, Milton Friedman, Paul Krugman, Amartya Sen or Joseph Stiglitz, just to quote a few). These reflections being very much value based (despite their very elaborate mathematical content) and context dependent, they are likely to go on for ever, or at least as long as humanity.

Among the concepts created and discussed by economists about wealth creation one can find the concept of capital. In today's business context capital can be the amount of cash and assets owned by a firm, or the amount of money invested to generate an income, or the factors of production used to create goods and services. It can be also the wealth of an individual or of a nation. Basically, and although many definitions can be found depending on the context where it is employed, we will consider for the present paper capital to be 'wealth accumulated with a view to produce more wealth'.

Capital therefore, as a source of wealth, has taken various forms in history. It could be argued (and disputed) that capital has been called: natural resources for the hunter-gatherers of the Palaeolithic, or lands for the seigneurs of the middle age, or machines and factories (or a brand itself) for industrialists, or money for bankers and hedge-funds owners… Despite these transformations one can nevertheless identify a constant ambivalence shared by the various avatars of capital and, furthermore, a trend towards de-materialisation in its history.

1. 1. AN AMBIVALENT NATURE

First, the notion of capital has remained ambivalent through the ages. It could be said to have two faces like Janus, one being open and bright, creating wealth, and the other closed and dark, increasing the gap between poor and wealthy in a society at the expense of the poor.

Marx [3] was seeing the capitalism as a system of exploitation. Capitalists use to pay the labour force of their workers less in "exchange value" than the workers produce in "use value". The difference makes up the capitalist's profit, or in Marx's terminology, "surplus value". The work-wage bargains are therefore at the expense of the workers. This perception is still valid today in a number of circles. Modern re-interpretations can be found nowadays in the context of the critique of neo-liberalism, expressed not only by eminent economists such as Nobel Laureate Joseph Stiglitz, but also giving rise to the 'occupy' groups, i. e. grass-roots protest movements giving voice to the 'modern proletariat'… Other people on the contrary see no alternative to capitalism [4], deeming it not only to be the only system able to function today but also seeing very close ties to the very roots of democracy, such as individual freedom. The philosopher Ayn Rand and economist Ludwig von Mises are two key figures that in the 20th century dismissed the attacks against capitalism and defended its foundations arguing mainly of the moral right of individuals to live for themselves and of the fact that capitalism was benefiting all people in society.

1. 2. A TENDENCY TO DE-MATERIALISE

Second, beyond this ambivalence (likely to remain), it has been seen that the nature of the capital is obviously becoming more and more immaterial along the time. Its last avatar seems to be 'knowledge' under various forms (e. g. trade secrets, patents, know-how). Those possessing 'knowledge' – be they individuals, so-

cial groups, private entities or nations – can indeed create more wealth through innovation than those who know less.

In that respect, a recent OECD report [5] has shown that the OECD economies are increasingly investing in what is called Knowledge-Based Capital (KBC). KBC is seen as a wider range of intangible assets than R&D, such as data, software, patents, designs, new organisational processes and firm-specific skills, as opposed to physical capital such as machinery, equipment and buildings. This adaptation reflects a long-trend of economic and institutional transformations of the OECD countries and, as underlined by the report: "it creates new challenges for policymakers, for business and for the ways in which economic activity is measured. Many policy frameworks and institutions are still best suited to a world in which physical capital drive growth. New thinking is needed to update a range of policy frameworks – from tax and competition policies to corporate reporting and intellectual property rights." The rise of KBC induce therefore a need to improve the understanding of these challenges, notably in areas such as taxation, competition, intellectual property rights, personal data, and corporate reporting. Scientific and technological (S&T) knowledge being a particularly important form of knowledge, a lot of research have been performed since the mid–20th century on better understanding the relation between S&T knowledge, innovation and wealth production. All developed countries have their own R&I policies, showing a good correlation between the human and financial resources put in these fields and their level of growth. The Community level is no exception to the rule and shows a very active R&I policy as evidenced at European level by the recent commitments towards an Innovation Union, a European Research Area [6, 7] and the ambitious funding of Horizon 2020.

2. ACCUMULATING SOCIO-EPISTEMIC CAPITAL WITHIN SOCIO-EPISTEMIC NETWORKS

In order to cope with future challenges, "including political and economic change, energy concerns, natural resources, food supply, health, individual quality of life, and many more" [1], policy-makers today will have to set in place the right conditions for wealth creation related to science and technology. The place given to (or taken by) science and technology in the new society will be obviously of paramount importance, but what place?

What will be the main features of the relationship between science, society and the citizens of this new society? In this new society, what sort of capital will be at the root of the wealth creation? What will be its preferred form/nature? What could be the strength of such knowledge-based society and the opportunities offered to it? What could be its weaknesses and the threats looming above citizens?

2. 1. ECONOMIC EFFICIENCY, DEMOCRATIC DIALOGUE AND SOCIO-EPISTEMIC NETWORKS

Capital tends to dematerialise with time. Although knowledge can hardly be considered material, it can be argued that at least some aspects of *explicit knowl-*

edge can be materialised. A publication, a patent, IPR rights can be written down, exchanged, acquired. This is less the case for *tacit knowledge* and this is even less the case for the *relationship between individuals*. This does not prevent sociologists to argue that these relationships can be an added value for a society. They call these relationships 'social capital'.

"In sociology, social capital is the expected collective or economic benefits derived from the preferential treatment and cooperation between individuals and groups. Although different social sciences emphasize different aspects of social capital, they tend to share the core idea "that social networks have value". Just as a screwdriver (physical capital) or a university education (cultural capital or human capital) can increase productivity (both individual and collective), so do social contacts affect the productivity of individuals and groups." [8]

Reinforcing social networks can therefore enhance the social capital in a given territory/society and favour wealth creation. Interestingly, Robert Putnam distinguishes two important functions of social networks within a society. One is 'bonding', i. e. reinforcing the links between similar people, and the other one is 'bridging', i. e. reinforcing the links between different people. Even more interestingly he showed that the two functions are mutually reinforcing. Societal cohesion and social capital can therefore be strengthened by strengthening 'bonding' and 'bridging' among social networks.

The importance of networks is also implicitly acknowledged in the context of most of R&I policies. In our modern global economy, companies face global competition in highly complex markets. Even for big companies it has become virtually impossible to have the complete sets of skills, expertise and technology to develop new products and services. R&I strategies therefore are becoming more dependent on external collaboration with other actors than on 'own' skills, expertise, technology, patents and know-how. These other actors can be other companies, but also public sector organisations such as universities, research institutes, user groups (professionals, consumers) and sometimes citizens (the so-called 'quadruple helix innovation models'). Innovation is thus evolving towards 'Open Innovation'.

Furthermore well-functioning and open social networks are said to be instrumental to reduce the chances and costs of 'downstream' rejection of innovation by users and/or society, and the STS literature emphasises the importance to realise 'communities of practice' in relation to normative considerations for democratic governance.

It is therefore argued here that the capital of the new society will combine scientific and technological knowledge dimension and social networks characteristics with their ability to bond and bridge. In other terms, the capital of the new society will be immaterial (and without any possibility to materialise), made of relationships between people of various natures (citizens, researchers, industry, media, civil society organisations, policy makers, science museums, teachers and professors, etc.) within social networks and around S&T issues. We propose to call this capital 'socio-epistemic capital' and the constitutive social networks 'socio-epistemic networks'.

2. 1. 1. THE NEED FOR A FOURTH (NON) INDUSTRIAL REVOLUTION

The first industrial revolution began in Britain in the 18th century with the mechanisation of the textile industry and that the second one came in the early 20th century with mass production. Economists argue that the third industrial revolution is already under way with digital manufacturing [9]. Jeremy Rifkin goes even further [10], suggesting that the third industrial revolution involves not only manufacturing processes but a whole new way of conceiving human relationship to the biosphere, based on the combination of internet and renewable energies (see also the notion of 'anthropocene'). All three revolutions have their preferred source of energy: wood and coal, oil, atoms and now renewable energies. But they did not change fundamentally the power games in decision making as far as S&T progress is concerned…

There could very well be a fourth revolution, not necessarily industrial but rather societal, leading to the 'new society'. It should be reminded at that point that 600 hundreds years ago China had in place the necessary components for starting the first industrial revolution and that this did not take place because of too tight controls from the rulers. Even if the components of a third industrial revolution are there in Europe, there is therefore no guarantee that it will succeed and that society can reap the fruits [11, 12] and enjoy the enormous productivity gains brought by the two previous industrial revolutions.

Technological feasibility does not necessary mean economic success and societal, democratic progress [13]. In the same way, good communication campaigns do not necessarily lead to the acceptance of technologies in society [14]. Many researchers and observers have pointed out that science and technology are value loaded in various ways and that the interactions between science and society have to move upstream if scientific progress is to find a harmonious and efficient translation in society [15, 16, 17].

This is precisely what a fourth (non) industrial revolution could bring: successful societal dialogues on S&T progress through socio-epistemic networks.

2. 2. AN ASSESSMENT OF THE POTENTIAL OF SOCIO-EPISTEMIC NETWORKS

Socio-epistemic networks could therefore be a way to promote more harmonious and more efficient relationships between science, society and the citizens in Europe. What can be expected from these socio-epistemic networks in terms of strengths and weaknesses?

2. 2. 1. STRENGTH AND OPPORTUNITIES

The development of Information and Communication Technologies (ICT) during the third industrial revolution gave impetus to a lot of mathematical studies on networks. Interesting parallels can be drawn between ICT hardware networks and

social networks in terms of efficiency [18]. Here is what can be found on the advantages and disadvantages of Hybrid Network Topology:

1. Reliability: Unlike other networks, fault detection and troubleshooting is easy. The functioning of the network is not affected by the default part that can be isolated and corrected.
2. Scalability: It's easy to increase the size of network by adding new components, without disturbing existing architecture.
3. Flexibility: Hybrid Network can be designed according to the requirements of the organization, optimizing the available resources. Special care can be given to nodes where traffic is high as well as where chances of fault are high.
4. Effectiveness: Hybrid topology is the combination of two or more topologies, so we can design it in such a way that strengths of constituent topologies are maximized while there weaknesses are neutralized.

Could it be that such reflections on Hybrid Network Topology could apply to human networks? Could the reliability, scalability, flexibility and effectiveness of these hybrid ICT networks compare with those of the hybrid socio-epistemic networks in the hyper-connected society of the future?

When mapping hyperlinking networks on the web (e. g. on controversial issues such as synthetic biology or climate change) ICT researchers have already evidenced the existence of networks they qualified as socio-epistemic [19] or epistemic [20]. This type of comparative research should certainly be pursued as S&T related issues are very likely to blossom on the web of the new society.

It is argued here that the strength of the new society will derive from the number and quality of the relationships between its basic components within socio-epistemic networks. Such relationships will indeed enable upstream dialogues resolving conflicting values and interests [21, 22, 15]. Socio-epistemic networks will also harness the creativity of all the basic components of the society towards finding solutions to the challenges it faces, maximizing innovation capabilities [23]. The real wealth of the new society will therefore be its cohesion around the main S&T challenges. Success calling success, the socio-epistemic capital will therefore be as cumulative as the other types of capital!

2. 2. 2. WEAKNESSES AND THREATS

As seen above, capital is an entity that has the property to create wealth for individuals or groups of people, hence also to increase the gap between those who have and those who have not. In a given society, capital is necessarily associated with some kind of redistributive power, be it soft (e. g. social redistribution) or violent (e. g. revolution). The new society will probably not be an exception to the rule. Therefore, the wealth created, if not redistributed, will induce tensions and tend to lower the socio-epistemic capital.

Another aspect of concerns will be linked to the ownership of the system allowing the relationships to be created. Pricing of such a service will also be an issue. The orthodox Marxian vision sustain that the mode of production was first based

on slavery (e. g. in ancient Rome) before moving to feudal serfdom (e. g. in medieval Europe) and then to capitalist societies. Will this go on? Will there be new classes in the new society based on the level of knowledge? On the capacity to know? On the capacity to liaise? Will relationships between people become commodities? In other words, will we be able to sell and buy relationships? Or address books?

Many more questions arise when pushing the comparison between socio-epistemic capital and usual forms of capital. Will this socio-epistemic capital obey the rules described by Schumpeter when referring to 'creative destruction'? What will it mean? What will be the impacts on the Kondratiev phases? On Juglar and Kitchin cycles? Etc.

From a sociological point of view as well, how will Bourdieu's reflections on capital be translated in a new society relying on socio-epistemic capital?

"Capital, which, in its objectified or embodied forms, takes time to accumulate and which, as a potential capacity to produce profits and to reproduce itself in identical or expanded form, contains a tendency to persist in its being, is a force inscribed in the objectivity of things so that everything is not equally possible or impossible. And the structure of the distribution of the different types and subtypes of capital at a given moment in time represents the immanent structure of the social world, i. e. the set of constraints, inscribed in the very reality of that world, which govern its functioning in a durable way, determining the chances of success for practices." [24]

There are many more questions relating to the socio-epistemic capital: How will it be transformed into wealth? What will be the corresponding wealth? Will the wealth created be more sustainable, as it will be informed by more diverse networks? Will this capital really stay immaterial? Or will it materialise in an unexpected way? How will it be transmitted? What will be its impact on democracy? What will be its impact on freedom and other fundamental rights?

Despite the lack of answers to these questions, and most probably because of the perceived strength and opportunities above, the accumulation of socio-epistemic capital through the promotion of socio-epistemic networks is already taking place, e. g. through the growing support to Responsible Research and Innovation.

3. PROMOTING SOCIO-EPISTEMIC NETWORKS THROUGH RESPONSIBLE RESEARCH AND INNOVATION

Responsible Research and Innovation (RRI) is a concept supported by the European Commission since 2010. It was not completely new at that time, as the notion of responsibility was taken forward by industry earlier on since the 80's (e. g. 'Responsible Care') and this notion is still alive in various contexts (e. g. through 'Corporate Social Responsibility', 'Responsible investment', 'Responsible business'). Responsibility has been also largely debated by philosophers during the 20th century for obvious historical reasons (e. g. Hannah Arendt, Emmanuel Levinas) but also for reasons directly related to S&T progress (e. g. Hans Jonas).

Many understandings and definitions of responsibility can be found in the literature but the following (given in the context of CSR) is interesting for illustrating RRI:

"Responsibility is literally what it says – our ability to respond. It's a choice we make… To be responsible is to be proactive in the world, to be sensitive to the interconnections, and to be willing to do something constructive, as a way of giving back. Being responsible for something means that we are entrusted with realizing its potential, turning promise into reality. Taking responsibility is a way of taking ownership in our lives, of acknowledging our own hand in the shaping of destiny. Responsibility is the antidote for victimhood." [25]

Indeed, this "sensitivity to the interconnections" and this idea of "taking ownership" of our own destiny can be found as well in Responsible Research and Innovation as understood by the European Commission. It is therefore directly linked to the notion of socio-epistemic networks.

3. 1. RESPONSIBLE RESEARCH AND INNOVATION IN HORIZON 2020

The Barroso Commission II, in its Europe 2020 strategy, outlined the societal challenges confronting Europe for which actions must be taken. Europe 2020 also identifies R&I as being key in addressing these societal challenges, while at the same time generating smart, inclusive and sustainable economic growth for Europe. But how then to ensure that outcomes resulting from R&I will be adequate for society in the long run? How can we be sure that solutions to the societal challenges based on R&I will correspond to the needs of the various societal actors?

In order to ensure this adequation to societal needs, all societal actors (researchers, citizens, policy makers, business, third sector organisations…) must work together during the whole R&I process. This co-creation process, aligning the R&I outcomes to the values, needs and expectations of European society, has been termed Responsible Research and Innovation (RRI) by the European Commission.

In practice, RRI is a package aiming to better engage society in R&I activities. This package touches mainly upon civil society engagement in R&I, supported by further activities enabling easier access to scientific results, better uptake of the gender equality and ethics dimension in R&I, and formal and informal education to science.

RRI has become a crosscutting issue in Horizon 2020. As such it will be found at work throughout the 2014–15 Work Programme of Horizon 2020.

As Robert Putnam would have said, through its RRI approach, Horizon 2020 is now 'bonding', i. e. reinforcing links between similar partners, as well as 'bridging', i. e. creating links between dissimilar partners in RRI endeavours, therefore creating socio-epistemic capital in European socio-epistemic networks. This is illustrated through the following examples taken from Part II 'Industrial Leadership', Part III 'Societal challenges' and Part V 'Science with and for society' of Horizon 2020.

3. 1. 1. RRI AND INFORMATION AND COMMUNICATION TECHNOLOGIES (ICT)

"ICT brings unique responses to society's challenges such as the growing needs for sustainable healthcare and ageing well, for better security and privacy, for a lower carbon economy and for intelligent transport. The overall aim of EU research and innovation in ICT under Horizon 2020 is to bring the benefits of progress in these technologies to European citizens and businesses." [http://ec.europa.eu/digital-agenda/en/information-and-communication-technologies-horizon-2020]

The capacity (and the deliberate will) of Horizon 2020 to create socio-epistemic networks is obvious in the case of actions related to ICT. Many topics of the first calls for proposals of Horizon 2020 relating to ICT are adopting the RRI approach and are dedicating to it significant amounts of money. Two of these many topics are worth to be highlighted here in order to illustrate how socio-epistemic networks will be created through platforms of exchange and coordination.

The "Collective Awareness Platforms for Sustainability and Social Innovation" topic (ICT 10) will harness the collaborative power of ICT networks to create awareness about the multiple sustainability threats our society faces. Its Digital Social Platforms will facilitate the transposition of societal solutions to larger groups active on transnational scales. Multidisciplinary proposals addressing critical factors for demand-driven societal innovation are welcome by the European Commission and findings should be transferable and scalable to other societal challenges.

The "Human-Centric Digital Age" topic (ICT 31) will function as a common platform to coordinate and support RRI in ICT R&I areas of Horizon 2020. It will explore also the two-way interactions between technology and society and lay the foundation for future ICT developments.

3. 1. 2. RRI AND NANOTECHNOLOGIES

The need for weaving such links between science and society did not escape to policy makers in charge of Nanotechnologies as well, all the more so as they promoted already since 2005 a 'safe, integrated and responsible Nanosciences and Nanotechnologies strategy' [26]. They aim explicitly to foster RRI in this sensitive field. The description of the "Societal engagement on responsible nanotechnology" topic (NMP 32 – 2015) speaks for itself:

"Transparency, knowledge and societal engagement are key factors in addressing societal concerns regarding the use of nanotechnology, including nanomaterials. An essential element of a safe and responsible nanotechnology governance is an effective and informed dialogue with all stakeholders, enhancing public confidence in nanotechnologies."

Although the whole description of the topic would be worth mentioning, the scope of the topic itself at least deserves to be highlighted here:

"The proposed action should identify current best practices in societal engagement to establish a multi-stakeholder platform at EU and/or at national level in a number of EU Member States and Associated Countries, involving a balanced representation of

researchers, Civil Society Organisations (CSOs) and Non-Governmental Organisations (NGOs), scientists in the field of Social Sciences and Humanities, industry and policy-makers to develop a shared understanding of the current and potential future (economic, social and environmental) benefits and risks of advancing nanotechnology."

3. 1. 3. RRI AND 'MOBILITY FOR GROWTH'

The need to build socio-epistemic networks is also apparent at various degrees in all the societal challenges tackled by Horizon 2020. This is the case for the Societal Challenge 'Mobility for Growth' for example where the specific challenge to tackle is described as the need for "*a sound understanding of behavioural and societal factors – including economic, social, demographic, cultural and gender issues where relevant – that influence transport demand and supply*" with the aim to ensure that "*in shaping transport policies and R&I activities, the values, needs and expectations of the society are met*".

The scope of the topic is also clear as to the need for fostering socio-epistemic networks: *"A forum for communication, collaboration, relationship-building should develop multi-stakeholder interactions and produce an action plan for innovative solution/options for transport and mobility to advance the agenda of the transport sector and society at large. The work should be inclusive of the state of the art of ideas, trials and business endeavours on new mobility concepts."*

The orientation of the topic is also obvious in the description of the expected impact. The setting up of this participatory framework is expected to "*ensure an inclusive approach in providing a comprehensive overview of new forms of mobility and transport, and their implications for users, the environment, society as a whole and policy makers*", "*promote innovative/alternative business models and social innovation*" as well as "*enhance corporate social and environmental responsibility*".

3. 1. 4. RRI AND 'SCIENCE WITH AND FOR SOCIETY'

Last but not least example, the Part V 'Science with and for Society' of Horizon, gifted with 462,2 M€ will be entirely dedicated to the promotion of RRI, be it through the advancement of the understanding of RRI or through coordination and support actions aiming to implement pilots all across Europe. It will address the attractiveness of science education and scientific careers, the gender equality issue, the integration of science in society and the governance for the advancement of RRI. It will help research institutions to adapt to the future society through institutional changes.

3. 2. RESPONSIBLE RESEARCH AND INNOVATION IN OTHER POLICIES

R&I are too important to be left to R&I policy makers alone! The promotion of socio-epistemic networks will be crucial in other settings as well. It is the case for example for the structural policies at European level.

Since more than 20 years now the European Commission has constantly taken care of the coordination between its R&I policy and its structural policies. The importance of knowledge policies (Research, Innovation and Education) under structural policies has been growing and the support to regional smart specialisation has been introduced in the Framework Programmes. Horizon 2020 has a line dedicated to "Spreading Excellence and widening participation" with an attached budget of 816,5 M€.

From the European Structural and Investment Funds (ESIFs) perspective, R&I is one of the four priorities of the Partnership Agreements negotiated in 2014 between the Member States and the European Commission. Nearly 25% of the EU Structural Funds (about €86 billion) have been invested in R&I under Cohesion Policy between 2007 and 2013 and the Cohesion Policy 2014–2020 will further concentrate funding on R&I.

ESIFs will set in place a new strategic approach based on 'Smart Specialisation Strategies', drawn by Member States and Regions. The 'Smart Specialisation Strategies' will use local know-how and build on the existing strengths and assets of the regions. They will actively involve the key stakeholders: researchers, businesses, the innovation community, and public authorities, so that they can identify the real needs of the local economies. They will not only focus on new technologies, but also on new ways of exploiting current knowledge and new ways of doing business.

Such 'Smart Specialisation Strategies' will obviously reinforce the socio-epistemic networks in the European regions. There are good complementarities and synergies to exploit with the European Research Area policy that is striving for lowering the barriers to mobility of researchers, knowledge and technologies in Europe. It is worth noting at that stage the converging analysis done by the European Commission – Joint Research Centre regarding the need for increased diversity and tolerance of complementary perspectives in the context of the European Research Area [27]; the authors remind us in their conclusion of the words of the famous philosopher of science Paul Feyerabend arguing that state powers should take responsibility for the diversity of perspectives in knowledge production.

CONCLUSION

On our small and limited Earth, the new society will face many economic, social and environmental 'singularities' (e. g. in terms of economic growth, population, energy, and biodiversity) that will have to be dealt with without societal disruption. Wealth creation will have to be disconnected from social and environmental damages. It will rely much more on knowledge and immaterial capabilities. In a medium to long term future, successful societies will be societies possessing the highest socio-epistemic capital. The transition towards these new societies should therefore favour the accumulation of this socio-epistemic capital through the creation of and support to socio-epistemic networks.

Possessing already a well organised stratified governance system, Europe is very well placed for reinforcing overall its socio-epistemic capital. The present

trend towards Responsible Research and Innovation, supported by the European Commission under Horizon 2020, will help prepare the ground for the blossoming of socio-epistemic networks and the smooth resolution of societal challenges.

Will it be possible then to harness all these European socio-epistemic networks for the good of the European citizens? Will this meta-network of human brains so-constituted be the ultimate avatar of the capital in the emerging new society? And will we be wise enough to make it deliver the expected wealth and well-being for all? This is another story!

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