European University Association Contribution to the Public Consultation: "'Science 2.0': Science in Transition"[1]

September 2014

With 850 members across 47 countries, the European University Association (EUA)[2] is the largest and most comprehensive organisation representing universities in Europe. 17 million students are enrolled at EUA member universities. As the voice of Europe's universities EUA supports and takes forward the interests of individual institutions and the higher education sector as a whole.

Recognition of the issue

1. Do you recognise the trends described in the consultation paper as 'Science 2.0'?

Yes, but with a different emphasis on particular elements of "Science 2.0". The trends described in the consultation paper as "Science 2.0" capture key aspects of the "Science 2.0" movement, including (a) an evolution in the dynamics of science and research enabled by technology/IT changes, the growth of research data/outcomes, the increased internationalisation of the research community and pressing societal challenges; (b) the fact that "Science 2.0" will entail changes in the dissemination and assessment of scientific research, as well as in scientific recognition systems. Changes are also expected in higher education teaching and learning practices, such as Massive Open Online Courses (MOOCs) and the growing use of technology to develop and/or improve coursework and platforms for online learning.

Nevertheless, the potential for "Science 2.0" to speed up the knowledge transfer among scientists and scientific disciplines should be explored in the light of the emergence of complex research issues that require new interdisciplinary approaches and skills to address grand challenges. Additionally, "Science 2.0" could contribute to foster young peoples' curiosity and interest in research and in pursuing research careers.

Promoting researchers' exchange and scientific cooperation through exploitation of the array of "Science 2.0" activities, such as scientific blogs, open data, source code, open review, among others. These web-based tools can foster the cross-fertilisation of interdisciplinary research activities and hold great potential given the rising number of researchers operating in a globally networked digital system. This can have a positive impact not only in terms of addressing grand challenges, but also in strengthening the competitiveness of the European science and research system overall. Notwithstanding, there are concerns related to "Science 2.0" activities which should be carefully

[1] http://ec.europa.eu/research/consultations/science-2.0/consultation_en.htm
[2] www.eua.be

considered in the near future. These include potential legal constraints, confidentiality issues, intellectual property rights, scientific recognition systems for "Science 2.0" activities, or quality assurance of non-traditional research outputs.

Implications of "Science 2.0" for society, the economy, and the research system

2. With regard to the first three priorities you indicated above could you please specify what kind of policy intervention would be desirable?

- **Open Access**

As one of the actions towards improving the efficiency and efficacy of research and boost the innovation capacity of Europe, the European Commission has made open access a general principle of Horizon 2020. This represents a significant and valuable step. However, further progress at European level is necessary in the field of open access and the Commission can play an important role here.

A structured stakeholder dialogue on open access to research publications (involving key players, such the research community (based in universities and non-university research institutions), public funders, policy makers, and the scientific publishing houses) would be of substantial added value. Such dialogue should be done in the light of several key issues such as scientific recognition systems (e.g., potential motivation of researchers to mainly continuing publishing in high-impact-factor journals due to their importance for career progression); and the flexibility in open access policies at member-state level, given the differences between the higher education and research systems in Europe.

Such dialogue would help fostering debate and promoting the exchange and dissemination of good practice and could ultimately increase the potential and impact of open access policies at European level. Additionally, given the ever-rising costs of maintaining and up-grading university libraries, journal subscriptions and digital resources publication costs, it is crucial to find effective alternative open access business models which are sustainable over time. This will be essential to make sure that the overall publication system is sustainable and thus supports the dissemination of knowledge. Policies could encourage the development and adoption of good practice regarding both the "green" and "gold" approaches to open access to scientific publications.

In short, we think that, in order to continue fostering the advancement of knowledge and scientific excellence, unnecessary premature regulation or over-regulation should be avoided. In any case, policy makers should consult extensively with universities and other research performing organising (essential actors in both production and peer-review of research) if they were to develop policies in this area, and take into account the differences between the research systems in Europe.

- **Research Data**

Policies should also encourage scientists to communicate the data they produced out of publicly funded research. This should be done in ways that are intelligible, assessable and usable for other relevant specialists and where the data justifies it (i.e., assessing the costs and benefits associated with data curation is important, since in some cases preservation costs for the research data might outweigh the benefits).

Thus, policies should seek to support data standardisation and data reuse for exploitation, while taking into account the particularities of the different fields. For example, policies could encourage the development and adoption of good practice and information sharing guidelines or protocols.

Likewise adequate infrastructures and financial support are needed to create a favourable environment for the exploitation of the new, related "Science 2.0" activities. For example, IT-infrastructure development, including their upgrade and maintenance, as well as software development, will require additional human and financial resources.

- **Text and Data Mining**

With the rapid development of information technology, vast amounts of new information and data have and will continue to be generated on a massive scale. Techniques such as text and data mining allow broader exploitation of the already available knowledge and have the potential to lead to new and faster scientific discoveries in areas as diverse as biological science, particle physics, media and communications. In its ongoing efforts to review and modernise the EU copyright legislative framework, it is important that the Commission considers creating an exception to allow researchers to apply text and data mining techniques for scientific research, when the purpose of that research is to benefit both individuals and society at large. In particular, researchers must be able to read and analyse electronic material without having to relicense what they already have legal access to. This would have a substantial value in terms of encouraging scientific and business innovation in line with the Europe 2020 strategic goals.

"Science 2.0" has the potential to foster the growth of new types of scientific cooperation and knowledge transfer, and thus lead to a corresponding increase in alternative contributions from researchers (e.g., datasets, code or contributions to wikis and blogs). At present, publication of peer-reviewed papers is the main cornerstone of research jobs, and promotion and peer-review is considered the best available system for scientific assessment. However, data sharing and early-stage communication is meant to become also an important criterion for career progression and reward. Therefore, changes in the ways scientific outcomes are assessed (i.e., metrics) and in scientific reputation systems will be required as "Science 2.0" activities develop/expand. This is a complex issue that is perhaps better suited for policy intervention at a later stage. In particular, substantial debate between policy makers, research community, funders, and other relevant stakeholders, will be required to establish efficient mechanisms for assessing the quality of the new types of scientific contributions, as well as to support decision-making processes aimed at reforming reputation systems. (For additional details, please see the section on the "Role of research funding organisations, member states, and the European Union" below.)

The novelty of the "Science 2.0" movement will also bring additional challenges in terms of policy intervention. For instance, given the diversity of "Science 2.0" activities and outputs, careful examination will be required when defining how to assess the quality of "Science 2.0" scientific contributions (especially if aiming to link them to research funding opportunities); most likely a flexible approach will be needed with quality measures linked to the type of scientific input. Likewise, careful analysis and evaluation of the impact of the different "Science 2.0" activities will be needed and should provide an important basis/input for policy developments in the years to come. EUA's view is therefore that premature policy measures should be avoided and that regular and ongoing dialogue between the multiple stakeholders should be promoted to boost the impact of policy measures and to capture the dynamics of the "Science 2.0" movement.

3. Are there specific disciplines with more potential than others to engage with 'Science 2.0'? Why?

Sharing ideas and data is the heart of science and, as such, all disciplines have the potential to engage with "Science 2.0". However, "Science 2.0" activities can vary across disciplines.

For instance, the wiki "OpenWetWare" has been developed in an effort to promote the sharing of information and know-how among researchers in the field of biology and biological engineering. It currently includes laboratories on five continents, dozens of courses and interest groups, and hundreds of protocol discussions. Another example is the Digital Research Infrastructures for the Arts and Humanities (DARIAH), which aims to facilitate long-term access to, and use of, all European Arts and Humanities digital research data as well as connect a network of people, information and tools.

4. Are there specific disciplines with potential to engage with 'Science 2.0', but where uptake so far has been slow? Why?

Concerns about ethical and privacy issues are high and may lead to some reluctance in engaging with "Science 2.0" activities. For instance, when the research involves patients or other human subjects, privacy is an immediate and necessary concern. It is worth mentioning that in January 2012 the European Commission proposed a major reform of the EU legal framework on the protection of personal data, aimed at updating and modernising the principles in the 1995 Data Protection Directive to guarantee privacy rights in the digital age. The proposed Regulation aims at establishing a single, pan-European law for data protection and includes a set of provisions for scientific research. EUA has been following the process closely and, in April 2014, issued a statement highlighting the importance for the Data Protection Regulation to have proportionate mechanisms that protect individuals' privacy in health and medical research while also meeting the needs of scientific research. EUA's statement addressed important issues such as international transfers of data and the secondary use of personal data in scientific research, which are relevant also in the context of "Science 2.0" activities. It is worth noting that the evolution in the dynamics of research enabled by technology will indubitably bring important challenges in terms of data protection, text and data mining, and copyright issues, among others. Uncertainty and/or concerns about these important issues may result in some disciplines holding back from getting involved with the "Science 2.0" movement and activities straightaway.

Additionally, issues of secrecy are present in some scientific areas and may also lead to some reluctance in engaging with "Science 2.0" activities. For instance, in more applied research areas there is recurrent concern of not disclosing research ideas when the work might lead to a patent.

Role of research funding organisations, member states, and the European Union

5. Which 'Science 2.0'-based activities would be desirable to be taken into account under the European Research Area?

- In the Communication on "A Reinforced European Research Area Partnership for Excellence and Growth" (July 2012), the European Commission identified "Optimal circulation, access to and transfer of scientific knowledge including via digital ERA" as a priority area.

As the next step to build upon "common principles" for open access that are now well-developed within the scientific community and agreed by all the ERA SHOs, it will be important to engage in an SHO dialogue at European level to explore effective alternative open access business models which are sustainable over time. Such models must reflect the impact of digital technological developments on the process of producing scientific publishing, as well as focus on creating operational conditions for open access to be sustainable in the long term and to meet the needs of researchers and of society at large.

- With researchers increasingly operating in global and digital networks, new types of technical knowledge and skills will be required to support researchers with computational and data expertise and allow effective exploitation of "Science 2.0" potential. In particular, technical knowledge will be required for efficient data management, as well as for handling, analysing and storing large amounts of digital content and support networking and information sharing.

Thus, formal education for the emerging professions of data scientists, computation experts, e-infrastructure experts will be required. The necessary training will have to be specified and consequently update existing university curricula or develop new ones. To help tackle these challenges, Europe's universities are already working to provide innovative research and training environments and they should be further encouraged and supported in this aspect (see policy intervention measures proposed in the section "Implications of 'Science 2.0' for society, the economy, and the research system" above.)

- There is a need for developing new scientific recognition systems as scientists will progressively be taking more advantage of the research dissemination opportunities available in "Science 2.0". In particular, the assessment of research and academic activity will require the development of new metrics adjusted to the variety of "Science 2.0" activities, tools and outputs based exclusively on research excellence. Taking account of alternative ways of publication of research results will be necessary to show the productivity of the European science and research system. Changes would however require extensive consultation to develop reliable and widely accepted additional research metrics.

Likewise, one of the upcoming challenges will be to ensure that appropriate reputation management systems are in place. Development of "Science 2.0" activities will most likely lead to the proliferation of scientific authorship and fragmentation of research outputs. Notwithstanding, such explosion in the number and nature of scientific contributions will pose challenges in terms of assessing authorship and the novelty and originality of the scientific contributions. EUA's view is that this is a critical issue and that there will be a need to conduct studies to gather further knowledge on the topic and assess relevant procedures for tracking authorship in the context of "Science 2.0" activities (thus avoiding plagiarism scenarios). Such studies will be important also to ensure the excellence of science and should be considered in the context of policy developments in this area.

- The growth of new types of scientific cooperation and exchange fostered by "Science 2.0" will require an emphasis on the evaluation of the impact of the "Science 2.0" activities themselves. It is expected that "Science 2.0" will foster interdisciplinary and collaborative research, and will promote new scientific advancements which would not have happened otherwise. Examining the real impact of "Science 2.0" activities will be important to identify the most relevant ones and concentrate support and promotion measures on them.

- Additionally, research is clearly a driving force in higher education and "Science 2.0" has the potential to also open new paths in terms of innovative and transformative instructional/teaching approaches. For instance, brought together by a joint team from the universities of Southampton, Manchester and Oxford in the UK, the "myExperiment" wiki offers a collaborative environment that encourages users to contribute to a pool of scientific methods, build communities and form relationships.