Liquid Publications Green Paper

This paper has been written by Judith Simon, Aliaksandr Birukou, Fabio Casati, Roberto Casati, and Maurizio Marchese, based on input from the entire consortium of the LiquidPub project[1]. The recommendations have been collaboratively authored and are endorsed by the consortium.

Paper structure

[1] The list of contributors is available at http://project.liquidpub.org/partners-and-contributors/liquidpub-teams

PART 1: Paradigm shifts in scientific knowledge creation, dissemination and evaluation

1. Introduction

In the FET-Open Project "LiquidPublications", researchers from a variety of different backgrounds aimed at proposing a paradigm shift in the way scientific knowledge is created, disseminated, and evaluated, by studying scientific practices of publication and developing both theoretical models and web-based instruments to assist the production and dissemination processes. In the following we will outline the main **results**, leading to **insights** and lessons learned from our project. Our gained expertise allows us to formulate a number of concrete **recommendations** hopefully useful for improving processes in research and scholarly communication. These recommendations are directed at different stakeholders in research, such researchers themselves in their different functions as authors or reviewers, research funders (EU and national funders), libraries, learned societies (such as IEEE, ACM, ICST), Publishers, Universities, Evaluation Agencies as well as society at large.

2. Major Achievements of LiquidPub

We conducted research and aimed at improving research at various stages of the process of scientific production and dissemination. The key points are

a) that researchers **make individual decisions** as to what and where to publish and with whom to collaborate,

b) that the results of these decisions **are public scientific knowledge objects** (SKOs) that contribute **both** to the **general body of knowledge** and to the **reputation** of their authors (and of institutions, funding agencies and states),

c) that the **instruments** for producing and disseminating SKOs strongly impact epistemic processes and results.

2.1. Modeling Scientific Knowledge Objects

In the project, we have developed a model to address artifacts, processes and agents involved in research. The core of the model are scientific knowledge objects (SKOs), their characteristics and structure as well as relations amongst them and to agents and processes in research.

2.1.1. Characteristics of Scientific Knowledge Objects

The main conceptual reframing of the issue of scientific knowledge production is based on the recognition that its products are diverse and have different roles in scientific practice. Scientific artifacts are modular, evolutionary, and collaborative scientific knowledge objects which come in different forms (multi-facetedness) and sizes or levels of details (granularity). They are related to each other in multiple ways to produce a web of scientific knowledge consisting of entities and links between them.

Multi-facetedness, modularity, and **granularity** all refer to the fact that objects necessary for scientific knowledge creation come in increasingly different forms, sizes, and levels of details. If we think about scientific artifacts, we may first think of classical textual scientific knowledge objects, such as journal papers, books, dissertations, encyclopedias, etc. However, software and data sets, pictures, and diagrams or experimental stimuli are also knowledge objects essential in the processes of creating scientific knowledge. Recently, blog posts, videos and a diversity of multi-media also play different roles in the process of research. Hence, scientific artifacts are by no means only textual, but come in other formats, a fact which needs to be accounted for. Moreover, reviews and the opinions of researchers on content are also important knowledge objects because they help us evaluating and filtering content.

With respect to modularity, we argue that even the most classical textual scientific artifact, the scientific journal article, is in itself a modular product, which can be sub-divided into sub-automatic parts. State-of-the-art or method sections, experimental stimuli or even the references can be used and re-used independently. Moreover, they also can be used for more nuanced credit attribution, if the authorship is attributed at this sub-atomic level. Moreover, different types of contribution, which may not be reflected in the textual artifacts itself (e.g. the provision of ideas or the raising of research grants that enabled the production of the paper) should be indicated in a production box to entangle authorship order and make the attribution of credit as well as the tracking of responsibilities more precise (cf. Casati, Origgi, Simon (2011) for a more detailed analysis).

The granularity refers to the way an artifact is decomposed into parts, but also to the level of details used in such a decomposition. For instance a presentation about a research paper normally contain much higher level of details (coarse-grained) about the main contribution than the paper. Furthermore, a technical report related to the paper can go even in lower level of details (fine-grained), for instance, by introducing code listing implementing described algorithms.

The **evolutionary** (**liquid**) aspect of scientific artifacts refers to the fact that they change over time. Papers, for instance, usually develop from initial ideas to first drafts and are then continually revised, often by taking into account feedback from others, until they are finally released. While the act of publication then is a time stamp which is needed to mark priorities, each paper has a life before and after publication. If we want to promote early sharing, we have to make sure that while re-use is facilitated, authors retain credit for their work[2]. This evolutionary aspect also holds true for non-textual artifacts, which are changed and modified over time. Indeed a major characteristic of the Web 2.0 consist in the agile and iterative re-assembling and remixing of content until it reaches a desired form. It is likely and also desirable that the re-use of modular (parts of) scientific content will also increase. Yet, since scientific knowledge depends upon the embeddedness of claims into an epistemic context, the tracking of references will be of crucial concern. Since change over time is often due to feedback from other, we should now consider a final crucial characteristic of scientific artifacts.

Scientific artifacts are often **collaboratively created** entities although the degree of collaboration may change. In the least collaborative form, an individual researcher may write an article all by himself, without asking for feedback from any of his colleagues. However, any scientific paper has to make reference to previous research and embed itself into a research context. Hence it is collaborative at the very least with respect to this acknowledgement of related works. Moreover, even such an article receives some form of review – either before or after being released, which is the another form of collaboration. Most publications nowadays are however much more collaborative, the majority being multi-authored, which reflects the highly collaborative nature of contemporary academic research (e.g. Hardwig 1991).

2.1.2. Modeling the structure and relationships of SKOs is an indispensable element

SKOs can be related to other SKOs in various ways and these relations need to be understood and modeled in tools supporting contemporary research practices. For example an experiment (a SKO) over a data set (another SKO) can be described in a paper, a presentation, or a videos (all SKOs). Both the experiment and the papers can be improved versions of previous attempts, or can build on the knowledge described in other SKOs. Accordingly, we see the space of scientific content consisting of knowledge organized as nodes in a graph, that can be connected and annotated by authors, editors or even readers. The reason for assuming that *anybody* can define relationships, not just authors, is because in this way we can leverage the power of the community to build knowledge by annotating and linking resources above and beyond what authors would do, thereby facilitating the task of finding and navigating through knowledge.

SKOs can themselves be seen as structured objects. The standard journal article is, so to speak, an **atomic** element. It has a certain "roundness" or completeness in itself. However, this does not mean that the journal article is unstructured. An analysis of the scientific paper reveals a modular deep structure underneath its “linear” surface order, the standard scientific articles consist of an abstract, a state of the art section, a method section, a results section, etc. (see Giunchiglia 2010 for the research on patterns of SKOs). We propose that each of these sections presents a **sub-atomic SKO** that should receive full recognition.

---

[2] Hence the development and adoption of norms of fair use as well as the adoption of permissive and granular licenses needs to be supported, see Recommendations.

2.1.3. Credits in scholarly publishing: moving towards better, structured reputation attributions

> "I am officially the author of over 296 peer-reviewed journal articles, as of May 26, 2006. Yes, that's correct: 296 articles. Many of these I have not even read."[3]

As knowledge is increasingly produced in a collaborative and evolutionary way and is disseminated in different forms, authorship and credit attribution becomes more complex, fine-grained, and possibly even subjective.

Based upon the SKO model, we propose a dedicated credit attribution to sub-atomically individuated parts of an atomic SKO. This type of practice is standard in the acknowledgement for complex cultural objects such as **movies**, where credit attributions are made fully explicit and are indeed the result of complex negotiations. Per our proposal, as a general rule, each sub-atomically individuated part of an atomic SKO can be credited with names of the authors for that part. If we take the example of a scientific paper, apart from the Title/Keywords and Acknowledgments modules that are not proper SKOs (i.e. independent content units) each other module has an autonomous life and authorship. That is, each of these units has metadata associated that specify its title, authors, acknowledgements, keywords and tags. We can re-conceptualize a SKO as a whole as an application that manages roles, permissions and accesses to its various subatomic parts. Credits for each module can be weighted differently according to specific policies of institutions and copyright permissions can also be assigned according to specific policies. Sub-atomic SKOs can thus be quoted independently of the SKO they are part of. Their authors can get independent credit as they can list them in their own CV and activity reports. Moreover, we propose a production box on top of each scientific article in which lab directors or idea givers can be acknowledged. This production box enables the disentanglement of honorary or management credit attribution from other types of attribution. In this box we can also credit authors from which we reused material with varying extent of modifications. Various aspects of this credit attribution model have been exemplified and implemented in Interdisciplines.org (microcredits), in liquid books (credit attribution in case of reused content) and in kspaces (subjective credit attribution), described below. This kind of credit attribution in publishing could give rise to a **Hollywood model** for crediting scientific publications.

2.2. Knowledge Creation and Dissemination Processes

[3] http://web.me.com/david.c.williams/projects/hepauthors.html, a very candid statement by physicist David.C.Williams. Notice that it is not uncommon to publish papers with hundreds of authors. See for instance Measurement of the *ZZ* production cross section in $p\bar{p}$ collisions at $\sqrt{s}$=1.96 TeV, http://inspirebeta.net/record/896254?ln=fr#, a paper with 421 authors, or a paper Initial Sequencing and Analysis of the Human Genome, published by Nature and listing approximately 2900 authors at http://www.nature.com/nature/journal/v412/n6846/extref/412565aa.html. It is simply incredible that unstructured lists of authors be considered and, what is worse, measured.

In parallel with the establishment of a model for scientific knowledge, we have identified and actively experimented with knowledge creation and dissemination processes and tools that are expected to be conducive to improvements in the production and dissemination of SKOs. These processes and tools started out with different origins and motivations but, a posteriori, we can recognize a common theme that is about blurring the distinction between knowledge *sharing* and *publication* as well as between *creation* and *dissemination*, thereby supporting a more interactive and conversational way of building knowledge.

2.2.1. Liquid Books

We have developed and experimented a novel model for creating and distributing books (http://liquid.realtimebooks.net/). In this model, authors share material (and so, collaborate, as authors in an ordinary book or in a wikibook[4]) but each author is then free (within the boundaries of a contractual agreement that we have identified) to take any of the shared material and edit/organize in any way they want, to then have their own edition of book. Such personal edition still leverages the knowledge of the group but that does not require everybody to share the same view on the content or organization of the book. In liquid books, quality is expected to grow over time (new editions are planned at least once a year). Together, these aspects of liquid books not only allow for continuous and collaborative improvement but also lower the entry barrier (being characterized by relatively rapid evolution, the first edition does not have to be perfect). Hence, they may encourage more potentially good, but busy authors to begin writing a book. The key issues here **are not IT-related** but rather related to the setting up of a suitable contract, licensing, credit attribution, royalties and dissemination model.

2.2.2. Liquid Journals and Instant Communities

Liquid journals are **evolving collections** of interesting and relevant links to scientific contributions (whether freely or not) available on the web, collected according to a formal or informal process, and that can be public or private. Considering journals as collections of links means that **journals do not own the contributions**. We assume contributions are posted elsewhere (web pages, traditional journals, etc) and so they are independent of their appearance in a journal. Thus, many journals can then refer to the very same contribution. This "appearance" of contributions in journals is an important information we exploit for measuring "interestingness". The rationale behind this model is that we see journals as a mechanism for people to find and share interesting and diverse content, for themselves or for their research group, thereby **blurring the distinction between sharing and publishing**. Content is added to journals via a variety of applications designed to capture knowledge in different contexts. Such applications include liquid conferences, discussed next, instant communities (designed to collect knowledge during an event such as a panel or session at a conference), and others. Liquid journals, instant communities, and other knowledge capturing and sharing applications build on top of an environment and ecosystem, called *knowledge spaces*, that facilitates knowledge sharing, linking, and

[4] http://www.wikibooks.org/

annotation. Details and tools are available at http://liquid.kspaces.net/ and http://project.liquidpub.org/tools.

2.2.3. Liquid Conferences

A Liquid Conference is a conference where the articles evolve from the initial stage of an abstract to a full article by receiving opinions, reviews and collaborations that help the authors to make this evolution. The concept of a LiquidConference is exemplarily implemented in the platform **Interdisciplines.org**, a new software developed within the LiquidPub project that allows an intuitive organization of high-quality research meetings through the Web. Each conference hosted on Interdisciplines contains a set of papers, authors, discussants, moderators, reviewers and organizing institutions. Each author has access to a dashboard in which he or she can write a paper, co-write a paper by assigning different authors to each sub-part of the paper, edit personal information, select copyright licenses, visualise previous versions of the paper. Following the ideas developed within the LiquidPub community, each paper has a "sub-atomical" structure, and each part can be written by different authors, evaluated and rated by different reviewers.

2.3. Analysis of Existing Practices

A good deal of our research focused on the analysis of current practices and approaches. Key elements here concern dissemination and evaluation.

2.3.1. Analysis of current evaluation practices

We have studied the **effectiveness of peer review and citation count** as evaluation and quality assessment methods, mostly in the area of computer science. As a result of the study we have shown that i) peer review has a rather limited effectiveness in identifying papers that are likely to have an impact on science, and ii) citation-based metrics, besides being biased by non-scientific factors, produce very different results depending on the specific formalizations of different citation-based metrics (e.g., number of citations vs h-index vs paper-rank).

2.3.2. The informality of scientific dissemination

Despite the progress in the technology (Internet, Web 2.0) and development processes (agile software development, open source movement) the current model of publishing and evaluating scientific contributions has not changed in decades. Therefore, besides the analysis of the as-is status, in the project we have identified alternative methods for scientific dissemination which, from initial explorations, appear promising in supporting an effective knowledge dissemination. The underlying principle is to allow knowledge dissemination in the scientific community to occur in a way similar to the way we **share knowledge** with our colleagues **in informal settings**. We observed that when we interact informally with a small team of colleagues dissemination is very effective. We are free to contextually choose the best format for communicating our thoughts and results, we share both established results as well as latest ideas, we interact and carry on a conversation (synchronously or via email or messaging systems), we comment on other people's contributions and papers and observe relations among various contributions. Even when we remain in the domain of papers, we found that we often come to know interesting papers not by doing a web search or scanning the proceedings, but because we "stumble upon" them, that is, we have colleagues pointing them to us via email or mentioning them in a conversation (along with their comments), i.e. knowledge spreads *virally*.

3. Evaluation and Reputation

Evaluating content, but also people is a crucial activity in research. Both types of evaluation are related, which explains why the production of SKOs not only contributes to the body of knowledge, but also to the reputation of researchers. An important epistemic function of reputation (of researchers, venues, etc) is that it helps us to filter and select content. Hence, the evaluation of researcher and knowledge objects, the relevance, use and potential misuse, of reputation are highly relevant social aspects of research. Below we introduce the various tools we developed for addressing the issues of evaluation and reputation from different angles.

3.1. Iterative rankings: a better way to aggregate people's opinions

It is a common situation in science, and many other areas of life too, that people evaluate and rate objects (let them be scientific papers, books, DVDs, or something else). A sophisticated algorithm that takes into account ability or reputation may produce a fairer or more accurate aggregation of ratings than the straightforward arithmetic average. Recently several **co-determination algorithms** were proposed where estimates of user and object reputation are refined iteratively together, permitting accurate measures of both to be derived directly from the rating data. The results can help to better evaluate scientific contributions, select papers for a conference, or even rank movies rated by movie enthusiasts. We studied and evaluated these algorithms, generalized them to be able to work with **multidimensional ratings** (think of evaluating objects according to various criteria), and implemented them in an efficient code that can be easily used to process this kind of data.

3.2. Homophily-aware citation metrics: countering biases in quantifying impact

Citation metrics are an established means of quantifying the impact of research. Their attractiveness partly stems from their simplicity. However, this same simplicity makes them **vulnerable to biases and strategic behaviors**. One such bias is that researchers naturally tend to cite papers from researchers with whom they have had social contact. As a result, such metrics promote papers targeted at a closely-knitted community where they would be more readily cited -- to the detriment of boundary-spanning and cross-community papers that have a broader but possibly less voluminous set of citations. To counter this bias, we designed a family of citation metrics targeted at assessing the breadth of impact of research publications, researchers and research communities. Through experimental evaluation, we demonstrated that the proposed "**homophily-aware citation metrics**" can effectively discriminate between highly-specialized, inward-looking research communities, and outward-reaching communities whose results have an impact beyond their specialized field. In the course of the study, we identified strong biases towards intra-community citations in several highly-ranked research conferences. We foresee that adoption of homophily-aware citation metrics may foster research publications with broader and more diverse citations, which contribute to more fluid knowledge dissemination across research communities.

3.3. DASS: a diversity-aware search engine for research material

In recognition of the biases related to social proximity and in order to support more diversity in research, we developed DASS, a prototype of a search engine that researchers can use to **identify papers that are related to one of their working papers**. The novelty of DASS is that it is designed to ensure **diversity in the search results**, avoiding the trap of recommending papers stemming from a narrow research community. When ranking the search results, DASS takes into account not only the topics of the papers, but also the underlying co-authorship relations. In particular, DASS down-ranks papers with authors with whom the user has co-authored papers in the past. Also, once a paper is included in the search result, other papers by the same authors are filtered out, thereby bringing up publications by other authors. This way, DASS maximizes the diversity and representativeness of the papers it recommends. We foresee that the use of DASS would foster links between research communities that would otherwise be missed.

3.4. OpinioNet: a reputation model based on the propagation of opinions in structural graphs

Researchers usually have implicit opinions on scientific contributions, people, venues, etc. Opinions may be described through peer reviews, citations, subscriptions, and so on. These opinions are not unrelated, rather when they judge the quality of a paper based on the venue in which it is published, this is a case of opinion propagation from the journal to the paper. With OpinioNet we have formalised a reputation model that introduces the notion of 'liquid' reputation measures through the flow (or propagation) of opinions amongst related entities. The novelty of this work is that the equations are designed in a way to promote 'better' research behaviour, such as **encouraging quality over quantity**, encouraging the **reuse** of existing material and **discouraging new versions of the same work** unless their contribution is worthwhile, encouraging the collaboration with authors that contribute to the quality of the paper and discouraging it otherwise, and so on.

3.5. Charms: a charter management system that provides automated GUIs

Charters are means to specify rules of interaction. For instance, in the field of scientific publishing, charters may specify how papers are submitted and reviewed in conferences, how coauthors may collaborate on a given project, and so on. The tool *Electronic* *institutions* provides means to easily specify and automatically execute such charters. Charms is built on top of electronic institutions and its novel contribution is in helping maintain GUIs in an efficient and automated manner. For instance, every time the charter's specification is modified, the graphical user interface (GUI) is automatically generated accordingly. This is useful because charters in the publications field are continuously evolving. For example, the review process of the same conference series usually evolves over the years, modifying rules on how authors can argue in reply to reviewers' comments, whether reviewers can see each others comments or not, and so on. As such, being able to simply modify the rules of interaction and have the GUI automatically updated accordingly is a useful thing.

4. Towards actionable recommendations

To sum up, we zeroed in the social aspects of scientific production and dissemination, as any proposal for improving the quality of scientific production is bound to negotiate the complex interplay between researchers' **individual decisions**, the necessity to consider the **reputational contribution of SKOs**, and the important **feedback loops** created by dissemination and evaluation instruments. The models, analyses and tools we developed are all deeply rooted in an awareness of these social dimensions of the scientific endeavor.

One of the difficulties of the LiquidPub project was the mobilization of a critical mass of individuals. We would inscribe this under the heading of "lessons learnt". It is in general hard to create a new actor in the play of scientific production and dissemination (hence we preferred at some point to improve an existing tool, interdisciplines.org, as it already rested on an active community of subscribers.)

Indeed, current publishing practices are sustained by a **strong network of implicit incentives**: publication in top journals provides recognition, that leads to individual improvements (financial security, power). If any other model of publishing is to be put into effect, an alternate model of incentives has to be carefully managed.

Before we proceed to the recommendations, the authors want to share some considerations on how to support virtuous loops and how to avoid vicious loops in research. Since practices of evaluating researchers and research have a profound impact on the behavior of researchers, most of our considerations target aspects related to research evaluation.

Discipline bias. Current evaluation practices are biased towards research practices in fields such as biomedicine or high-energy physics. In such fields, mass-authored papers are rather the rule than the exception. Hence researchers reach quantities of publications that are unattainable in other research areas. Besides the sheer quantity, quality indicators, such as the impact factor are also biased towards fields such as biomedical research. Since publications practices differ in different fields this needs to be accounted for. Biomedically inspired metrics, in particular do not fit the humanities, where contributions other than journal articles, e.g. monographies,are important contributions. Remember that formats induce constraints - and there are topics which do not fit the format of a journal paper. **In short:** Re-think evaluation in the humanities and explore less traveled paths to the measurement of general impact of research in humanities: numbers of visitors at curated exhibits (Collini 2009); factoring in of time devoted to reading (Tenopir et al 2009a, Tenopir et al 2009b, King et al 2009); number of foreign editions of a book; etc. More generally, we need to be aware of disciplinary differences. Any solution, not only for the evaluation of researchers, but also for supporting the knowledge creation and dissemination process, needs to be flexible and adaptable to the needs of different communities.

Dangers of qualitative and quantitative metrics. A survey conducted in our project (Ponte & Simon 2010) showed that quality and quantity of publications still are the major factors in assessing the quality of researchers. If the quantity of publications counts too much, premature publication as well as the publication of papers with only modest improvements (paper slicing) will increasingly be used to beef up the CVs of researchers. Metrics such as the h-index were introduced to counter such tendencies. However, they come with their own problems and create their own citation-strategic behaviour (e.g., Kapeller 2010, Malle 2006). Hence, quality criteria need to be re-assessed keeping in mind that they always induce strategic behaviour which may be detrimental to research.

Even when quality of publications instead of quantity becomes the main criteria for evaluation, problems may emerge. Quality assessment today, at least in hiring decisions, frequently does not consist in reading the publication and assessing its merits directly, but rather in using the publication venue as a proxy for quality. Such focus on few venues with a high reputation also leads to the effect that researchers waste time in presenting their results by getting rejected in few high-ranked journals. Moreover, the acceptance of journals in specific digital libraries used as the basis for bibliometric indicators may put additional - and not always appropriate - constraints not only on *format* of research publications, but increasingly also on the *content* of research.

Counting publications and making use of different quantitative quality indicators also looms large in hiring and tenure decisions. While publications are surely at the heart of research, focusing too much on publications outsources quality assessment to the publishing companies (cf. Waters 2004). Especially in the social science and humanities, reading some of the articles of the applicant may lead to a more balanced assessment. In general, there is a necessity to **explore new paths in research evaluation and hiring policies** (cf. also Martin 2009). In particular we suggest a) not to outsource outsource evaluation to university presses (following Waters 2004) and b) to put a cap on number of publications a candidate can submit with their applications, e.g. 4 best articles, depending on discipline (following Malle 2006).

Transparency, openness, provisionality, plurality. Whatever formula one may develop to evaluate researchers and research contributions, there will always be biases implemented through each decision on the criteria and their respective weights. Moreover, people always find a way to cheat, see Labbé (2010) for a recent example of faking data to increase one's h-index. This phenomenon is neither new nor specific to quantitative metrics (e.g. Friedman & Nissenbaum 1996). However, quantification hides the subjectivity of the decision-making process that influenced the development of those metrics.

The reaction to this acknowledgment of unavoidable bias should not consist in a blunt rejection of quantitative measures. After all, discrimination and biases existed long before the quantification of quality in metrics; indeed the objectification of quality can also be regarded as a means to counter individual biases. Rather, each formula with its weighted criteria and evaluation metrics should be regarded as provisional and context-dependent. Metrics, the criteria and weights should be transparent, open to discussion and expected to change over time and depending on the context. Transparent, open, provisional, plural - these are characteristics of an ideal scientific discourse (Longino 2002). Applying these qualities to an evaluation system would make an evaluation system flexible without turning it into subjective arbitrariness.

Open access and easy consumption of content. We believe that open access copies of all research material published in publicly funded research projects should be made available in open repositories. While this would put some pressure on researchers to provide such copies, the benefits would be immense. Scientific advancement builds upon previous research and therefore depends upon the availability of content. Any restriction to the availability of scientific content has to be avoided because it constrains future research. Moreover, visible and publicly known repositories would also enable the interested public to access state-of-the-art research material. Given that the public funds research, the results should surely be available to them as well. In addition, as results are not just papers, it is important that other forms of results (such as data sets) are made not only available, when allowed by privacy regulations, but also understandable and easy to be leveraged by other teams. The same should be true for experiments and their repeatability, which is also an important way to verify project results (see the Sigmod experiment for an example of how rarely results are replicated (Manolescu 2008)).

Reconsider the excellence-rhetoric. Current rhetoric focuses strongly on excellence, thereby ignoring the fact that most researchers are distributed around the median. Giving incentives only to top researchers does not motivate the vast majority of researchers, whose efforts form the basis of most research. Furthermore, measuring excellence is very difficult as we have studied during the project, and very often great ideas come from young people who did not have the chance to prove themselves yet.

Increase your own accountability. We believe that signing reviews would be a good practice. It would make everybody more accountable, and reviews more thorough.

PART 2: LiquidPub Recommendations

While the considerations above are the opinions of the authors, in this section we provide recommendations from the LiquidPub team, which are based on our collective work and more generally on the expertise we developed when dealing with the various aspects of the project. Some recommendations are directly linked to our models and tools, and some others have a more general slant.

R1: [OPEN ACCESS] EU should recommend that project proposals should include plans for how to provide easy access to all knowledge produced in the project. Efforts towards lowering the barriers to accessing research results should be included in the evaluation and correspondingly there will be a deliverable on this aspect.

R2: [EVALUATION] Activate a Coordination and Support Action that provides, as result, guidelines for the funding agencies throughout EU on how to evaluate researchers, open to the new forms of knowledge dissemination processes of the digital age, either in recommendations or as example. Activate a Coordinated and Support Action to define ranking of publication venues, ideally adopted by the member states. The CSA should also define the maintenance and sustainability processes for this. The ERC could be involved in coordinating the maintenance processes for the resulting ranking. We hope that the considerations and suggestions provided in the conclusions in Part 1 of this paper can provide valuable input for the Coordination and Support Action.

R3: [COPYRIGHT] EU should require that all copyright transfer agreements for publications deriving from EU-funded projects should be replaced by copyright sharing agreements[5] between authors and publishers stating that authors:

- retain full rights to re-use their own work, including commercial uses, without needing permission, so long as the publisher-formatted version is not used;
- can freely redistribute verbatim copies of the publisher-formatted article for noncommercial purposes, and grant others the right to do so [in order to reduce the problem of multiple different versions];
- commit to crediting original place of publication in every re-use of material.

R4: [RESEARCH PROPOSALS] Account for the liquid and open-ended structure of research

[5] Similar agreements are already put in place by several publishers and funding agencies, such as the National Science Foundation and the European Alliance for Innovation (for the authors of Innovation Book Series).

Even research projects have a conversational nature and evolve with time. The EU and other research funders should recognize the liquid and open-ended structure of research proposal and consider ways to support it. In particular, delivering a list of detailed deliverables in the grant proposal ignores the fact that research results cannot be foreseen before the project starts. Such a practices may encourage proposals with lower innovativeness. **In short:** get rid of the deliverable structure in grant proposals. Give smaller seed grants on innovative ideas.

R5: [SUSTAINABILITY] Allow project consortia to allocate part of the project budget (upfront in the project proposal itself) to be used after the end of the project in order to sustain the value of the outputs of the projects beyond the project's lifetime, in cases where the output of the project is not commercialized but is of value to the research community or the wider community.

For example:

- a project developed a web-based tool for testing system specifications online. A subset of the project partners can apply for a supplementary grant to perform maintenance of this web-based tool past the lifetime of the project
- a project developed a data set. This data set becomes outdated after one year. Project consortium can apply for a grant to update the data set.
- an EU project produces a tool that is made available as an open source project. Project consortium can apply for a grant to maintain the open source project past the lifetime of the project.

During the final project review, reviewers will recommend whether or not the "sustainability funds" set aside for the project, should be released or taken back by the EU.

An extension of this recommendation is to allow projects to allocate a portion of the project’s budget to be used after the end of the project for seeding start-ups or foundations (e.g. non-profit organizations). The release of this funding will be approved following the final review, based on a business case put forward by the consortium during the final review. The reviewers would recommend that this seeding funding be released or not. If not, the funding goes back to EU.

References

Casati, Roberto; Origgi, Gloria; Simon, Judith (2011), Micro-Credits in Scientific Publishing, *Journal of Documentation* (in print).

Collini, Stefan (2009), Impact on humanities: Researchers must take a stand now or be judged and rewarded as salesmen, *The Times Literary Supplement,* November 13, 2009. Available at: http://entertainment.timesonline.co.uk/tol/arts_and_entertainment/the_tls/article6915986.ece

Friedman, Batya and Nissenbaum, Helen, (1996), Bias in Computer Systems, *ACM Transactions on Information Systems,* July 1996, pp. 330-347. See also: http://www.nyu.edu/projects/nissenbaum/papers/biasincomputers.pdf

Giunchiglia, Fausto; Xu, Hao; Birukou, Aliaksandr; Chenu, Ronald (2010), Scientific Knowledge Object Patterns. Proceedings of the 15th European Conference on Pattern Languages of Programs (EuroPLoP'2010), Irsee Monastery, Bavaria, Germany, July 7 - July 11, 2010.

Hardwig, John (1991), The Role of Trust in Knowledge, *The Journal of Philosophy*, 88 (12), December 1991, pp. 693-708.

Labbé, Cyril (2010), "*Ike Antkare, One of the Great Stars in the Scientific Firmament*, 22th newsletter of the **international society for scientometrics and informatrics**, June 2010. (extented version pdf).

Lanier, Jaron (2010), *You are not a Gadget*, Random House: New York. See also: http://www.jaronlanier.com/gadgetwebresources.html

Kapeller, Jakob (2010), Citation metrics: serious drawbacks, perverse incentives, and strategic options for heterodox economics, *The American Journal of Economics and Sociology*, 69 (5), pp. 1376–1408. DOI: 10.1111/j.1536-7150.2010.00750.x

King, Donald W.; Tenopir, Carol; Choemprayong; Songphan; Wu, Lei (2009), Scholarly Journal Information Seeking and Reading Patterns of Faculty at Five U.S. Universities, *Learned Publishing,* 22 (2) April 2009: 126-144. DOI: 10.1087/2009208

Malle, Bertram F. (2006), The actor-observer asymmetry in causal attribution: A (surprising) meta-analysis. *Psychological Bulletin, 132,* 895-919.

Manolescu, Ioana et al. (2008), The repeatability experiment of SIGMOD 2008, *ACM SIGMOD Record,* 37 (1), March 2008, pp. 39-45.

Martin, Brian (2009), Research Productivity: some paths less travelled. *Australian Universities' Review*, 51 (1), February 2009, pp. 14-20 http://www.bmartin.cc/pubs/09aur.pdf

Ponte, Diego & Simon, Judith (2010), Web 2.0 and Scientific Publishing: an Overview, Presented at the Free Culture Research Conference, Free University Berlin, 7.-9.20.2010. Available at: http://wikis.fu-berlin.de/download/attachments/59080767/Ponte-Simon-Paper.pdf?version=1&modificationDate=1286013297000

Tenopir, Carol; King, Donald W.; Edwards, Sheri; Wu, Lei (2009), Electronic Journals and Changes in Scholarly Article Seeking and Reading Patterns, *Aslib Proceedings: New Information Perspectives*, 61 (1) February 2009: 5-32. DOI: 10.1108/00012530910932267.

Tenopir, Carol; King, Donald W.; Spencer, Jesse; Wu, Lei (2009),Variations in Article Seeking and Reading Patterns of Academics: What Makes a Difference? Library & Information Science Research Volume 31, Issue 3, September 2009, Pages 139-148. Available online 18 April 2009. doi:10.1016/j.lisr.2009.02.002.

Waters, Lindsay (2004), *Enemies of Promise*, Prickly Paradigm Press: Chicago.