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Analysis of Emerging Reputation and Funding Mechanisms in the Context of Open Science 2.0

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Abstract
This report covers the outcomes of two studies funded by JRC IPTS to explore emerging drivers for Open Science 2.0. In general, Open Science 2.0 is associated with themes such as open access to scientific outputs, open data, citizen science and open peer evaluation systems. This study, however, focused on less explored themes, namely on alternative funding mechanisms for scientific research and on emerging reputation mechanisms for scholars resulting from Web 2.0 platforms and applications. It has been demonstrated that both are providing significant new opportunities for researchers to disseminate, share, explore and collaborate with other researchers, but it remains to be seen whether they will be able to bring about more disruptive change in how science and research systems function in the future. They could well do so, especially if related changes being considered by the European Commission on 'Science 2.0: Science in Transition' are taken into account.

FOREWORD

This report covers the outcomes of two JRC-IPTS funded studies, which explore emerging drivers for Open Science 2.0. In general, Open Science 2.0 is associated with themes such as open access to scientific outputs, open data, citizen science and open peer evaluation systems. Our studies focused on less-explored themes, namely on alternative funding mechanisms for scientific research and on emerging reputation systems for scholars.

The phrase 'alternative funding mechanisms for scientific research' refers to innovative and new approaches to financing research and development both from governments and private donors, using more open, bottom-up ways of selecting priorities and proposals (e.g. inducement prizes such as X-prizes and Grand Challenges, sandboxes, crowdsourcing). These mechanisms are currently complementing existing funding methods. However, they require scholars to have new skills more like those of entrepreneurs selling their projects to the crowd or to private parties. This, in turn, opens new ways for science to communicate with people in society, among other things.

Emerging reputation mechanisms refer to either social networking services or sites that utilise the social media, which offer the opportunity to build, promote and measure reputation. They do this by providing mechanisms for conducting various scholarly activities, typically disseminating research, and enabling the quality or impact of these activities to be measured, demonstrated, compared and - sometimes – rated in the form of scores that can be viewed by the community. Known examples include ResearchGate, Mendeley and Academia.edu. It appears that when building and showcasing scholarly reputation, the large majority of services only consider traditional research activities. Other types of scholarly activities attracted little notice (e.g. teaching). This indicates that dominant practice mainly conforms to the old standards of "Science 1.0".

Both alternative funding and emerging Web 2.0 scientific reputation platforms and services are providing significant new opportunities for researchers to disseminate, share, explore and collaborate with other researchers. However, they are still emerging and it remains to be seen whether they will be able to bring about more disruptive change in science and research systems in the future. They could well do so, if we consider related changes in the dynamics of science and research. These changes have been enabled by digital technologies and driven by globalisation and increasing societal demands for science to address the grand challenges of our times. The European Commission held a public consultation on 'Science 2.0: Science in Transition' and will run a validation process in 2015 to further consolidate the analysis of changes in the modus operandi of doing research and organising science (http://scienceintransition.eu/).

In addition, there is a wider trend towards "opening-up" education which affects teaching and how education is being organised and funded. The European Commission launched a number of initiatives in this area, following the 2013 Communication (COM/2013/0654 final) on "Opening up Education: Innovative teaching and learning for all through new Technologies and Open Educational Resources".

The JRC-IPTS "ICT for Learning and Skills" team is studying these changes, which cover the following interrelated research strands across all educational sectors: Open Education and OER, Innovating Learning and Teaching, Key Competences and 21st Century Skills. More than 20 studies have been undertaken on these issues, resulting in more than 50 different publications. All the studies aim to support European policies on the modernisation and innovation of education and training (DG EAC), the and development of key competences and qualifications (DG EMPL) the Digital Agenda for Europe (DG CNECT) and more recently, the Digital Single Market (DSM) initiative under the Juncker Commission.

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Part I

Analysis of Emerging Reputation Mechanisms for Scholars

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EXECUTIVE SUMMARY

Background and research questions

This is the final report of a six month (July – December 2014) exploratory investigation of scholarly reputation in the Web/Science 2.0 era, which focuses on the role that emerging reputational mechanisms and platforms play. Reputational mechanisms are the processes or methods used to build reputation, such as interacting with peers and disseminating output. Reputational platforms are the websites that combine and utilise these mechanisms to help build reputation, make it public and comparable. Reputational platforms allow for any or all of: (a) making one's research known to peers and other interested parties (b) sharing knowledge and information (c) giving/receiving expert feedback (d) impacting on others' research or knowledge, on industry, and on society. There are mainly two types of platform: 1) those based on the traditional view of scholarly reputation, which focus on citation and publication, such as Google Scholar and Researcher ID; 2) the emerging ones, the focus of this report, which are based around Science 2.0 principles and social media measurements, aspects that enhance the digital visibility and presence of scholars.

This report summarises the results presented in three interim reports produced for the Commission and reflects on the policy implications of their findings. For the detail behind the summaries please refer to: *D2: Literature review of scholarly activities and reputation mechanisms in Science 2.0*;[1] *D3: Identification, evaluation and mapping of emerging reputational platforms* (25 covered); and *D4: Five in-depth case studies* featuring scholars in 4 European countries and a reputational platform (Kudos) and its users.

Aims and research questions

Traditional and conventional ways of establishing and measuring scholarly reputation are being challenged by Web/Science 2.0 developments and the principal aim of the study is to understand what is happening on the ground. Might these challenges, for instance, lead to new practices that are more comprehensive and representative of scholarly achievement by going beyond the "publications and citations" paradigm? Also, how best can policy level actions support transformative changes in this field, if, indeed, they are needed at all? The study's key research questions in connection with the new reputational mechanisms and platforms are:

- Who are the key actors and stakeholders?
- What are the practices, motivations and experiences of individuals/institutions using these new emerging reputation mechanisms?
- What challenges do scholars face?
- What do scholars obtain from using them (e.g., work-related vs. social gain)?
- How are such issues as trust, privacy and risk managed and regulated by the stakeholders both through technical and non-technical means?
- What are the skills and attributes needed by individuals to participate in these platforms and what resources are drawn upon to support their use?
- What is the relationship between new reputation mechanisms and prospects for future scholarly success?
- What new indicators could be used to measure impact and importance of researcher activities in a more granular, transparent and comprehensive way?

[1] E Herman, D Nicholas, H R. Jamali (2015 – Forthcoming). 'Emerging reputation mechanisms for scholars'. - Literature review and a state-of-the-art appraisal of social networking services used to build, maintain and showcase scholars' reputation'. JRC Science and Policy Report.

Common perceptions challenged by the research

The study found that the common, albeit narrow perception of scholarly reputation being all about research performance is essentially very much true and therefore there is a need for corrective action to resolve an inequitable situation. Reputation is still very much associated with research activities and publication in high impact factor peer reviewed journals. Thus, although the reputation building component of the scholarly undertaking is potentially very well supported in today's era of Open Science 2.0, the price to be paid for adopting novel ways of working may arguably be seen as too high if an activity cannot be readily translated into conventional research outputs, as the case of teaching amply proves.

Attitudes, especially of those in senior scholarly positions, and hence very influential, are conservative and seemingly entrenched. This is perhaps not surprising given how important reputation is in the scholarly field. Practices seem set in concrete. Nevertheless there is a widespread belief, among the young and old, that there will be change and that emerging reputational systems/mechanisms will constitute the future and will have greatest impact on the careers of young researchers. There also seems to be a greater willingness among the young, women and social scientists to change the current reputational regime. Reputation is also a topic about which policy makers are yet to make their voices heard, although this study makes a welcome move in this direction.

What are the implications (positive and negative) for the scientific community?

Positives:

- **Reputational platforms will have a lasting impact and deserve attention**. As the quest for prestige is inherent to the scholarly undertaking, scientists are understandably interested and curious about practices that can furnish them with additional information as to how they perform against their colleagues. Reputational platforms, enabling scholars, as they do, to see statistical evidence regarding the impact, usage, or influence of their work without too much effort, certainly have the potential to serve their reputational goals. Indeed, the large majority of researchers, despite having some reservations, think that reputational systems are here to stay and that they will become increasingly important, and especially so for younger researchers, in helping fast forward their careers.

- **Clearly the benefits of reputational platforms for knowledgeable scholars are legion**. Thus, for instance, for the French economists interviewed the benefits are thought to be to: a) extend the network of people with which they can work and collaborate; b) obtain a better understanding of who are the most reliable and valuable contacts and stakeholders in their research field; c) obtain more efficiently information and contents on their research topics; d) attract the attention of their colleagues/contacts to their research topics and publications; e) make their research activity and their impact more visible to a larger audience and promote and provide evidence of their authority and reputation; f) be singled out by scientific editorial teams, scientific authorities and so on for jobs, collaborations and new responsibilities; g) build a dynamic digital identity they can control.

- **Improvements are on their way**. In the short-medium term reputational platforms look likely to embrace a wider range of activities outside of research publishing/dissemination. Thus, for instance, Kudos will be addressing the so called 'esteem factors': editorial board membership, role as a reviewer, society posts, invites to speak at conferences, etc., as well as policy improvement and changing practices and public engagement – things that funders in particular are interested in tracking.

- **Young researchers will benefit most and, possibly, be the drivers of change**. Young researchers generally have a more encompassing view of reputation than their older colleagues. Thus it was found that younger scholars (under 40) consider serving one's community, the production of literature reviews and textbooks, and the production of open educational resources to be more important for their careers than older scholars.

- **A powerful symbiotic relationship is being created**. With scholars increasingly visible digitally and active in social networking fora, novel methods of analysing and providing immediate feedback about the performance of a journal, an author or an article, via indicators gathered in the real-time social web, show good potential for becoming a necessary complement to the traditional citation-based metrics for evaluating scholarly performance. The potential is demonstrated by the Kudos platform.

- **There is some diversity, possibly showing early leaders and best practice.** Country data are not forthcoming from most of the reputational platforms so it is difficult to determine whether the EU is ahead or behind the curve. However, there are positive signs in the data we do have, Kudos usage data (February 2015), which shows that around 40% of their users come from the EU, with good numbers (in ranked order) being posted for the UK, Italy, Germany and Spain. The leading position of the UK appears to be down to: a) its strength in the scholarly publishing field; b) the fact that all platforms use English as the working language; c) the UK Government's evaluation exercise, the Research Excellence Framework, which puts pressure on British scholars to produce outputs and demonstrate impact. Women and social scientists are shown to be more favourably dispossessed towards the social media and Science 2.0 activities.

- **Strengthening the European digital economy**. Two of the, arguably, most pioneering and successful reputational systems (ResearchGate and Kudos) are located in the EU. Both are new businesses; 'pure players', organisations that originate and do business purely through the Internet and who had no existence before the Internet. This should boost the European knowledge base and digital single economy in what may turn out to be a very big and strategic area.

- **A strong reputational market which is here to stay and prosper**. The emerging mechanisms market is large and getting larger, with several dozen, substantial reputational platforms available to European scholars. In digital terms it is also a reasonably well established market with some services having been around a half-dozen years or more and some have become very big players on the global stage, with, for instance, Academia.edu boasting more than 18 million users and ResearchGate more than 5.5 million.

Negatives – pointing to the need for improvement/change/intervention:

- **Highly skewed.** Reputation for scholars in today's world is highly skewed towards academic research and the reputational systems largely reflect that reality. This state of affairs runs counter to today's changing societal priorities, which see the future in the globalised knowledge society as hinging not only on research and innovation, but also on education for all, and calls for the opening up of scholarship to participants from the entire range of the professional-amateur-citizen spectrum. Platforms and scholars need to be cognizant of this.

- **Teaching is the elephant in the room**. As a major activity of scholars, teaching is very much neglected. There can be very little excuse for this, in view of the goals and ensuing policy initiatives that have been driving the European academic enterprise for quite some time now, which see research and teaching not only as mutually dependent and reciprocally reinforcing, but also as equally important. Its overall prominence in the digital environment in which we find ourselves also speaks against the marginalisation of teaching. Many more

services, such as CourseTalk, are needed to review and rate courses and lecturers and identify/reward innovatory practices. However, given the costs associated with the decision to opt for a greater emphasis to be put on teaching pursuits, most notably where employment, promotion and tenure are concerned, for many scholars this is a no-go area and progress will not be easy.

- **Limited impact.** Emerging scholarly reputational mechanisms and platforms, while used, appear yet to make much headway in terms of establishing a reputation.

- **No one-stop-shop reputational service.** None of the existing platforms come even near to providing reputational building and maintenance opportunities for the full range of scholarly activities. Maybe just as well, given the monopoly power this would give a platform, although Google Scholar has such power in the traditional reputation area.

- **Uninformed and unquestioning**. Scholars are generally uninformed about the full reputational benefits of the new mechanisms and platforms. Largely, they tell us, because they are time-poor and so are unwilling to invest time on reputational mechanisms/platforms. Also, whilst they are faced with strong incentives to embrace open and participatory ways and means of working, these question some of the traditionally held elements of the scholarly practice.

- **'Lite' usage is commonly associated with the platforms and their mechanisms**. If scholars use the platforms, they tend to use them lightly and for other purposes, such as obtaining publications for free. Better news comes from buoyant usage data provided by Kudos, which is a platform that makes significant demands on the users and their time, and does not hide this.

- **There is very little in the way of institutional support for emerging mechanisms**. With recruitment of staff and their career advancements widely seen as contingent on proven scholarly achievements, most notably in research work, as measured by the quantity of papers published in high-ranking journals and the number of citations they obtain, managers generally provide little in the way of direction or support. The usage of the platforms is very much left down to the initiative and skills of the individual scholar.

- **There appears to be little in the way of funding-agency support for emerging mechanisms.** Although funding agencies play a potentially important role in bringing about change, as they have shown in forcing open access through despite widespread concerns, objections and apathy of scholars, at least for the time being the focus is on research publication based reputation when evaluating grant proposals.

- **There is a palpable mistrust of the social media** and what it can deliver in the way of reliable metrics and this stops a lot of scholars using emerging mechanisms. Dissemination of research via blogging/tweeting, holding administrative and management positions, dissemination of research via social networking, and citizen science projects are seen to contribute the least to scholarly reputation.

- **Market domination.** The USA is very much the dominant player, with around two thirds of all reputational platforms and the two biggest ones (LinkedIn and Academia.edu) based in the United States. US scholars are the biggest users of the Kudos platform. This might mean that the US will drive future developments and they will play to a US scholarly tune/agenda.

What are the implications for science policy-makers?

- In what is probably the most extensive review of scholarly activities in the digital age, more than fifty scholarly activities have been identified across the five main dimensions of scholarship - research, integration, application, teaching and co-creation. **All the activities identified, bar none, were found to have reputation-conferring goals and potentials**. The new scholarly activity schema produced in Annex 1 of this report should be widely promoted to win hearts and minds to a new scholarly reputation road map. And one in which there are more milestones than just those concerning research outputs.

- **There is a need for policy makers to turn the spotlight on the reputational aspects of teaching and learning activities**, maybe leading on those associated with Doctoral students/studies, where there appears to be some support amongst the scholarly community surveyed. Market forces alone do not look like producing the desired changes fast enough, if at all, unless stimulated, pushed and fed with data from, possibly, reluctant data providers.

- To affect the necessary timely changes, **there is a need to 'tip' reputational development in the direction that Science 2.0 is travelling** and the best way forward would be via small scale 'seeding' or 'laboratory' experiments, which would encourage the various stakeholders to tackle together the big challenges.

- **There is virtually no research, or even information, about the 'new actors' entering the field** (possibly, in their hundreds of millions) thanks to the information liberating and enfranchising influences of Science 2.0. In fact, the only reference to their existence seems to be in the recent studies exploring the increasingly widespread phenomenon of citizen science. And not surprisingly then, few platforms offer anything to the new actors. They certainly deserve special attention from policy makers, given their size, anonymity and the sheer uncertainly of their impact.

- **Trust is a major concern among scholars** surveyed. There is a need to further investigate at European level how a quality assessment framework for reputational platforms could help in building trust. Reputation is too important to leave standards, algorithms and policing wholly to the market. Discussions should be undertaken with the main players (funders, scholars and platform owners) towards this end.

- **Probably, change can only be affected speedily and effectively if funders are engaged in policy making.** They are the powers in the scholarly land (they can make and break scholarly reputation as it stands today) and see what they have managed to achieve regarding open access, and against widespread academic hostility and an unwillingness to change, because of a perceived 'dumbing down'. There are parallels here.

1. INTRODUCTION

Reputation is everything for the scholar. However, traditionally reputation has largely been measured in respect to just one scholarly activity and that is research. Furthermore, research reputation has largely been measured in respect to publication in high-impact journals and the citations these publications attract. Google understood this very early on and produced a service, Google Scholar, which exploits successfully (and further cements) this practice. So successfully, in fact, that university human resource departments recruit scholars on the basis of their Google Scholar scores, most notably its h-Index.[2] The scholarly reputation spotlight then falls on just one activity (research authorship) and one particular manifestation of that activity and its associated metrics. Clearly such a narrow view of reputation marginalises all the other scholarly activities and this skews scholarship and academe, because in this monolithic world it is authors publishing in top journals who obtain the reputation and hence the best and most senior posts.

This traditional and conventional way of establishing and measuring scholarly reputation is being challenged by Web/Digital Science 2.0 developments, which have:

- Given rise to new formats for conducting, publishing and disseminating science and research (and, indeed, for teaching as well);
- Ushered in increasing numbers of 'actors' and new types of actors (free-lance scientists, innovators, citizen researchers - we are all researchers now connected to the big fat information pipe);
- Provided new, more inclusive and broader ways of measuring scholarly reputation (the digital makes everything visible and recordable and new metrics abound, covering scholarly activities which have not previously been easy to measure and review, such as teaching and collaborating);
- And, directly flowing from the above, given birth to many more reputational systems, which provide a more open, inclusive and encompassing means of building and showcasing scholarly reputation.

The principal aim of this exploratory study then, is to better understand what the above changes mean for scholarly reputation. Might these changes, for instance, lead to new practices that are more comprehensive and representative of scholarly achievement by going beyond the "publications and citations" paradigm? Also, how best can policy level actions support transformative changes in this field, if, indeed, they are needed at all?

It was felt that the best way of achieving the aim was to take an evidence-based approach and gather data on emerging practices and mechanisms, focusing on the characteristics and use of the emerging scholarly reputational platforms. These platforms have been created to support a wide range of scholarly activities, ranging from sharing publications and datasets to collaboration that is carried out in the course of research (e.g., sharing artefacts such as lab notes and data sets) and engaging new actors in science (e.g., through citizen science). Within the communities of such platforms, these activities are turned into metrics that are used to build reputation and display it across the network leveraging well known mechanisms from social networking sites. This has given rise to new measurement "schools" based on various web-analytics and metrics to measure the reputation of scientific researchers.

The reputational platform market is in an experimental phase, with many services less than six years old, and this means it is fragmented with structure and 'winners' yet to emerge. And it is a relatively secret place, where data is hard to come by. Both these factors mean that this research

[2] http://scholar.google.com/intl/en/scholar/metrics.html#metrics

and the policies that might emerge as a result of it could ensure a fairer and more successful assessment of scholarly reputation.

The project was conducted in three stages, each feeding into the next:

1. **A comprehensive literature review and audit of scholarly activities in the digital age and associated reputational mechanisms.** First, guided by Boyer's (1990) well-established model, the range of scholarly activities was defined to provide the project's conceptual framework, which, in turn, provided the various tasks that scholars/researchers undertake, both online and offline, that do/might contribute towards building reputation. Second, existing mechanisms were examined to determine how reputation is constructed in the field of science, e.g., publishing and citations, endorsement, grants and rewards, downloads, ratings, social relations.
2. **A state of the art mapping and evaluation of online platforms that offer 'new' reputational mechanisms for scholars**. Each platform's offerings were evaluated and mapped against the model of scholarly activities established in 1) above, and novel and successful approaches identified. Platforms were identified through the published literature, by searching the Web and by asking scholarly networks. Platform evaluations were conducted by using information on the site and on the web, by previously published research, and by joining the site and exploring its features and functions as a 'mystery shopper'.
3. **Case studies whose purpose was to examine in detail how emerging reputational platforms and their mechanisms look/work from the scholars', institutions' and platform's point of view**. Five case studies were undertaken, four of them covering scholars in Poland, Spain, Switzerland and France and one case study of a UK-based 'emergent' reputational platform (Kudos) and its users.

2. FINDINGS

2.1 Defining scholarly activities and reputational mechanisms

2.1.1 Introduction

A good scholarly reputation is indubitably a central hallmark of success in the scientific endeavour on both the individual and the institutional level, indeed, one of its principal enablers (Merton, 1968). As Becher (1989, p. 52), contends, "the main currency for the academic is not power, as it is for the politician, or wealth, as it is for the businessman, but reputation". This, because with scholarly contributions subjected to communal evaluation, and scholarly rewards allocated communally, reputation is translated into many concrete consequences for the scientist (Reif, 1961). However, traditionally scholarly prestige has been related exclusively to rather narrowly defined and institutionalised research achievements, inevitably rendering many of the activities that form part and parcel of the work-life of a scholar rather marginal.

This state of affairs, long regarded as untenable (Boyer, 1990), runs counter to today's changing societal priorities, which see the future in the globalised knowledge society as hinging not only on research and innovation, but also on education for all (Altbach et al., 2009). In fact, it seems to call for realising at long last Boyer's proposition for re-defining scholarship in ways that reflect more realistically the entire range of its academic and civic mandates. By the same token, so do the emerging paradigms of the scientific enterprise in our era of Open Science 2.0, with its collaboration-centred, web-based socio-technical systems (Shneiderman, 2008) and open practices of scholarship (Veletsianos and Kimmons, 2012). The opening up of scholarship to participants from the entire range of the professional-amateur-citizen spectrum, whilst concurrently introducing a wider range of media into its processes and outputs (Goodfellow, 2013; Weller, 2011), certainly points to the need for taking a more wide-ranging, inclusive and representative view of scholarly achievement.

The literature-based conceptual framework for this study of emerging reputation mechanisms for scholars has been achieved, therefore, through a comprehensive, analytical exploration of the various, traditional and novel, offline and online activities, which comprise the present-day scholarly undertaking, and their potentially reputation building, maintaining and enhancing components (for the full exploration of the topic see D2 – Interim report: Literature review – scholarly activities and reputation mechanisms in Science 2.0[3]). As part and parcel of the affordances of Open Science 2.0, the scholarly arsenal of reputation building tools has already been greatly enriched by a host of innovative, social networking based platforms, techniques and metrics (Wouters and Costas, 2012; Van Noorden, 2014), which can be utilised interchangeably or complimentarily with more traditional ways and means of constructing scholarly standing. The question is, of course, to what extent these novel ways and means are utilised to accrue and secure scholarly prestige. This question, in its turn, is framed within the broader question driving the present study: how today's digital scholars actually build, sustain and enhance their standing and reputation.

2.1.2 A conceptual framework for scholarly activities

The point of departure for the analysis of current and emerging scholarly behaviours undertaken here is Boyer's (1990) seminal mapping of the broad territory of scholarly activity, which, although hailing back to the previous century, remains entirely valid in its basic observations and contentions

[3] E Herman, , D Nicholas, H R. Jamali (2015 – Forthcoming). 'Emerging reputation mechanisms for scholars'. - Literature review and a state-of-the-art appraisal of social networking services used to build, maintain and showcase scholars' reputation'. JRC Science and Policy Report.

to this day.[4] Still, any consideration of contemporary scholarly practices needs to address its changed and still fluctuating nature, which is why Boyer's (1990) model could not have served our purposes, were it not recently been analysed, updated and extended in a number of studies to reflect the realities of the digital age (Garnett and Ecclesfield, 2011; Greenhow and Gleason, 2014; Heap and Minocha, 2012; Pearce et al., 2010; Scanlon, 2014; Weller, 2011). Thus, the contextual basis for this exploration of scholars' changing work practices is Boyer's (1990) updated model of scholarship:

(1) **The scholarship of research** (discovery), the individual or collaborative creation of new knowledge;

(2) **The scholarship of integration**, the arraying of extant knowledge into larger intellectual patterns, often within a wider, cross-disciplinary context;

(3) **The scholarship of application**, the application of disciplinary knowledge and skill to societal/practical problems;

(4) **The scholarship of teaching**, the conveying of the human store of knowledge to new generations;

(5) **The scholarship of co-creation**, the participation of teachers, students and practitioners in the increasingly converging processes of knowledge production and transmission.

Using these classifications to categorise the entire range of tasks today's scholars typically undertake as they go about their pursuits in an increasingly open, digital and networked environment, the literature-based analytical review, presented in this study, focusses on their potential for establishing, maintaining and enhancing scholarly reputation.

The scholarship of research (discovery)

The scholarship of research, the disinterested pursuit of knowledge for its own sake and the benefit of humankind, is indisputably at the very heart of the scholarly enterprise, indeed, its principal professional endeavour and focal point. The primacy of the scholarship of research over other dimensions of the scientific undertaking plainly stems from the importance accorded to its stated goal of extending the stock of human knowledge, but it is also associated with the fact that research and publications are used as the yardstick by which scholarly success is measured (Boyer, 1990; Harley et al., 2010). Thus, according to Bazeley (2010), scholarly reputation is not merely a by-product of the research process but, alongside publications and impact, one of its three main outcomes. So much so, as Brew (2001) suggests, that a research project is actually a kind of social marketplace, where the products of research (publications, grants and networks) are exchanged for money, prestige or recognition. Perhaps not very surprisingly then, scholars' various activities in the course of their research undertakings, as delineated in Table I.1 below, all have been found in the analysis of the pertinent literature to have reputation-accruing goals and potentials.

Indeed, whether a research activity is performed individually or in collaboration with others, whether it is aimed at the actual producing of an original contribution to human knowledge, the dissemination of the by-products and outputs of research work, the networking and collaborating with colleagues or the assigning and calibrating of quality and trustworthiness to others' research outputs, it invariably seems to have a strong reputational focus alongside its scientific one (for the reputation enhancing benefits of research work practices see Table I.8 in the Annex; for an in-depth discussion of the topic see the aforementioned D2 – Interim report). However, with all that the quest for prestige is thus almost 'built into' conducting research, it is today's innovative, open and participatory ways of working that seem to have an especially compelling potential for the building/ maintaining/ augmenting of professional reputation. As you might expect, perhaps, for the research undertaking, wholly founded as it is on access to an abundance of knowledge, expert feedback and

[4] For example, *IEEE Transactions on Education* accepts manuscript submissions under three areas of scholarship, based on Boyer's categories.

the judicious utilisation of appropriate dissemination channels, is an evolving and iterative process, which can be well-supported indeed in today's Web 2.0-based digital world.

Table I.1: The scholarship of research (discovery)

Identifying a researchable topic
Planning a research project
Building upon previous knowledge
Requesting/providing help in locating research literature
Producing research output
Producing research output collaboratively
Producing research output collaboratively in large-scale projects
Producing research output by committed amateur experts
Releasing data to the scholarly community
Releasing methodologies, research tools and protocols to the scholarly community
Releasing laboratory notebooks to the scholarly community
Keeping up with new developments
Getting help for solving topical problems
Disseminating research results formally via traditional scholarly channels
Disseminating research results formally via Open Access scholarly channels
Disseminating research results formally via enhanced Open Access scholarly channels
Disseminating research results informally via active participation in conferences
Disseminating research results informally via repositories/websites
Disseminating research results informally via social media
Disseminating research results, ideas and opinions informally via scholarly social networking sites
Disseminating research results, ideas and opinions informally via blogs
Peer reviewing
Participating in open peer reviewing
Monitoring one's impact

Take, for example, the first stages of a research undertaking, aimed at producing an original scientific contribution. The process, from the detecting of a solvable gap in human knowledge to the achievement of new knowledge and/or enhanced understanding, requires that the researchers release or communicate ideas, progress, mock-ups, prototypes, draft results, etc., gathering feedback as they go. This can be done easily enough face-to-face, in a meeting arranged for the purpose or more spontaneously, say, in a conference, perhaps over the telephone, and most notably these days, via email, provided that the researchers mainly target for the purpose their colleagues. Arguably, though, how much more effective it can be, reputation-wise, if the net is spread wider, with the procedure taking place transparently on the web, spurred on to completion by continuous peer support and participation. As there can be little doubt that the greater one's visibility among likeminded people, the better it is for reputational purposes, the Science 2.0-afforded ability to engage more effectively, in different ways, and real-time with peers and interested community groups can certainly be conducive to visibility-associated, enhanced prestige.

To be sure, courtesy of the Web 2.0-enabled possibilities for scholars to congregate in a virtual area, common to all of them, in order to share their work, ideas and experiences, these days networking, the formation of bonds and solidarity among distributed individuals, and hence, working in collaboration, have become far more feasible and, from the perspective of reputation building, potentially more rewarding. In fact, today's scholarly environment is becoming more open and democratised, a trend manifestly epitomised in the transformation of the 'invisible college' from that 'small society of everybody who is anybody in each little particular specialty' (Price, 1975) to more of an 'invisible constituency' – a heterogeneous, open and loosely organised network,

functioning as a scholarly in-group within a specialisation, with crosscutting ties between researchers, be they university-affiliated or lay experts, low-status or high-status, from the core or the periphery, established or novice (Palmer et al., 2009). Plainly then, from a reputation-building perspective, taking an open, digital, networked and crowd-sourcing-based approach to research has unmistakable beneficial effects.

Nevertheless, as a recently completed research project on trust and authority in scholarly communications (CICS/CIBER, 2013) has shown, today's researchers may be wholly cognisant of the changing realities and possibilities of conducting research, but their behaviour in all aspects of their research undertakings, inclusive of reputation building, is clearly guided by the long-established norms of peer-reviewed publications and citation-based metrics. This is nowhere more evident than in the case of the novel platforms, techniques and metrics that can be used to compliment more traditional ways of reputation building for a synergetic effect. Still, researchers are unmistakably interested and curious about novel, social reviewing practices, be these explicit or implicit,[5] that can furnish them with additional information as to how they perform against their colleagues (see, for example, CICS/CIBER, 2013; Nicholas and Rowlands, 2011; Ponte and Simon, 2011; Procter et al., 2010; Van Noorden, 2014). Apparently then, these novel ways and means of passing judgment on research performance, although still at an evolving stage, are already seen as quite useful for reputational purposes. Enabling researchers, as they do, to see statistical evidence regarding the impact, usage, or influence of their work without too much effort, these alternative forms of impact measurement serve as 'technologies of narcissism', even if not yet as 'technologies of control' (Wouters and Costas, 2012).

The scholarship of integration

The scholarship of integration, seeking as it does to connect individual discoveries and isolated facts by putting them within a wider, often multi- or interdisciplinary context, is just as much concerned with creating knowledge as the scholarship of research. Thus, with many of the characteristics of the scholarship of research holding true for the scholarship of integration, too, it is hardly surprising to find in an analytic review of the literature that the entire range of integrative research activities, as delineated in Table I.2 below, all have potentially reputation-accruing capabilities.

Table 1.2: The scholarship of integration

Identifying a topic for a comprehensive literature review/textbook
Identifying a researchable multiple-faceted topic
Planning a comprehensive literature review/textbook project
Planning an integrative research project
Producing a literature review/textbook via traditional strategies
Producing a literature review/textbook via open strategies
Producing an integrative research output
Producing an integrative, multi- or inter-disciplinary research output collaboratively
Producing an integrative, often multi- or inter-disciplinary research output collaboratively in large-scale, distributed projects
Producing Open Education Resources (OER)

[5] Explicit review is the process whereby the scholarly work is made openly accessible, and the audience is invited to scrutinise, comment on or rate it. Implicit review is the capturing and integrating of usage metadata (page views and downloads, Twitter counts, Facebook comments, science blog postings, bookmarkings and reference sharing), in order to provide immediate feedback about the performance of a journal, an author or an article.

Indeed, whether an integrative research activity is performed individually or in collaboration with others, whether it utilises traditional or open and participatory strategies, it invariably seems to have a strong reputational focus alongside its scientific one (for the reputation enhancing benefits of integrative research work practices see Table I.9 in the Annex; for an in-depth discussion of the topic see the aforementioned D2 – Interim report). Offering, as this mode of scholarship does, cross-disciplinary solutions to real world, complex, societal, often global challenges, as well as integrative portrayals of multi-faceted scholarly knowledge in the form of literature reviews, textbooks or educational resources, it has the potential to contribute greatly to science and society. This can bring considerable reputational gains to the scholar, especially if they utilise for the purpose the social media based networking tools and platforms available today.

A case in point is the way the producing of a literature review/textbook can serve a scholar's reputation-building goals. Such an integrative, often multi- or inter-disciplinary interpretation of the extant knowledge and informed opinion on a topic necessitates the judicious selection and synthesis of high quality and trustworthy content from multiple formal and informal sources. Obviously then, it can certainly go a long way towards showcasing a researcher's scholarly expertise and proficiency and hence, his/her eligibility for peer recognition and esteem. If the researcher does so via open and participatory strategies, say, uses a social networking space for aggregating and collectively discussing an evolving body of literature on a topic, this can result in the additional reputational benefits accruing from the advancing of social networking and the enhancing of one's digital identity, both of which are inherent to the process.

Arguably though, the integrative scholarly activity which holds the greatest reputational potential is the producing of Open Education Resources (OER[6]), to be offered freely and openly for educators, students and self-learners on the web to use and reuse for teaching, learning and research. The creating of OER has important scholarly and societal purposes, most notably improving the quality of education and expanding traditional and non-traditional learners' access to it. Still, from the individual scholar's point of view, the strength of the practice lies in its capability to aid in building a network of relationships, often across disciplines, and in achieving public visibility and societal impact, all of which can greatly contribute to the enhancing of scholarly prestige.

However, taking this route certainly necessitates careful consideration on the part of the individual scholar, given the costs associated with the decision to opt for integrative research pursuits, most notably where employment, promotion and tenure are concerned. This, because not only does this cross-disciplinary mode of research work bring on a ‘production penalty’ (the transition between disciplinary boundaries can be quite time consuming), but also because the traditional academic career incentives do not stimulate it. So much so, in fact, that according to Rafols et al. (2012), with criteria of excellence in academia essentially based on disciplinary standards, interdisciplinary endeavours in general, and policy and socially relevant research in particular, are inevitably hindered.

An evolving solution to the problem, as proposed by both Weller (2011) and Rhoten (2004), is harnessing Open Science 2.0 afforded, more 'lightweight' forms of communication to help overcome existing disciplinary boundaries and thereby foster interdisciplinary knowledge sharing. Information sharing networks may indeed often yield 'harder to count', but equally important – albeit different – outputs such as public policy initiatives, popular media placements, alternative journal publications, or long-term product developments. However, while these are the opportunities that often draw individuals to integrative work, they are also some of the most under-appreciated and unrewarded activities within today’s academe, especially from a reputation building angle.

[6] Full courses, lesson plans, instructional modules, syllabi, course materials, textbooks, streaming videos, tests, quizzes, games, simulations, software

The scholarship of application

The scholarship of application, setting out as it does to aid the wider world outside academia via the judicious utilisation of scholarly knowledge and expertise, also has as its ultimate aim the creation of new knowledge, albeit this time it is via linking theory to practice through dynamic interaction. Thus, whilst the scholarships of research and integration reflect the investigative and synthesising research traditions, the scholarship of application moves toward engagement via serving industry, government or one's professional/disciplinary community. In any case, the activities comprising the scholarship of application, as delineated in Table I.3 below, just as much as those associated with the aforementioned two other modes of research-focussed scholarship, hold great potential for enhancing a scholar's standing and reputation.

Table 1.3: The scholarship of application

Identifying a researchable topic focussing on practical problems experienced by public/practitioner audiences
Identifying a researchable topic focussing on practical problems experienced in organisational/industrial settings
Planning a research project focussing on practical problems experienced by public or practitioner audiences
Producing an application oriented research output
Producing a community-interest driven, application oriented research output
Producing an application oriented research output through a PPSR (public participation in scientific research) project
Participating in the commercialisation of one's inventions/discoveries (filing patents)
Serving industry or government as an external consultant
Serving one's professional/disciplinary community
Popularising scientific knowledge

Indeed, each of the application oriented research activities has obvious reputation-enhancing capabilities for the scholar, whether it aims at devising solutions for societal, communal, organisational or industrial problems, at producing patented commercial applications, at benefiting one's own professional/disciplinary community or at popularising scientific knowledge for the general public (for the reputational benefits of application-aimed practices see Table I.10 in the Annex; for an in-depth discussion of the topic see the aforementioned D2 – Interim report). Take, for example, the producing of an application oriented research output: yielding as it does both formal, scholarly publications and popular ones, such as newspaper articles and television programmes, it affords scientific-achievements based eligibility for peer recognition as well as public visibility and societal impact, the latter of which, in its turn, can enhance scholarly prestige, too. By the same token, translating research-generated knowledge into commercial applications for economic benefit (for example, via filing patents) can help the scholar in achieving both scholarly and public visibility and in gaining both peer and societal recognition and esteem. No wonder then that application-oriented scholarship is seen as important for reputation-building purposes, as a recent survey amongst 3,748 U.S.-based members of the American Association for the Advancement of Science (AAAS) finds: the vast majority (87%) of the scientists canvassed supported the idea that participation in policy debates and engagement with citizens and journalists was necessary to further their work and careers (Pew Research Center, 2015).

It is important to note here, that the scholarship of application, in fact, the whole notion of science communicated with the express purpose of informing practice, is undergoing considerable changes these days, courtesy of the Open Science 2.0 afforded approaches to addressing community challenges. To be sure, as Grand et al. (2012, p. 683) suggest, with Web 2.0-based social media

tools, predicated on interpersonal networking, rendering the boundaries of the scientific community more porous, lay experts' participation can go beyond "counting, checking, and organizing data to involvement in the full complexities of the research process and in dialogue with researchers". These joint ventures, which, as Greenhow and Gleason (2014, p. 399) point out, "break down traditional binaries like research/practice, scholar/participant, inside/outside and contributor/user", can prove to be advantageous for both lay and the scholarly researchers. Obviously so: they all have the potential for entailing scientific-achievements based eligibility for peer recognition and career-related rewards and research opportunities. The opening of the entire process of research to the scrutiny of public collaborators and audiences also contributes significantly to the achieving of public visibility and societal impact, both of which can enhance scholarly prestige (Peters et al., 2008).

Not that application-aimed, professional-non-professional alliances hold no problems for scientists. Rather to the contrary. They may have apprehensions about failure for lack of shared language with lay participants; they may be concerned about time taken away from 'real' work; they may be worried that such publicly transparent practices may lead to their being 'scooped' (Jensen et al, 2008). However, perhaps above all, a major discourager for scholars to take on community-interest driven, application oriented research projects is that the outcomes may remain unpublished (Braxton et al., 2002). In the scholarly world, where success is measured by the number of publications in top journals, a project which accrues no scientific-achievements based eligibility for recognition is likely to be regarded as hardly worthwhile doing, indeed, much too costly (at least in reputational terms), although, as it has already been noted, public visibility and societal impact can boost scholarly prestige, too.

The scholarship of teaching

Readily understood to refer to the conveying of the human store of knowledge to new generations, the scholarship of teaching, as Boyer (1990) sees it, requires in addition that scientists take a studied approach to their pedagogy in order to achieve evidence-based 'best' teaching practices that can transform, extend and enhance students' learning. Fortunately, novel perceptions of the teaching/learning process, coupled with the affordances of Open Science 2.0, have the potential to realise Boyer's vision of the scholarship of teaching. Indeed, the literature-based portrayal of the range of traditional and novel activities comprising this mode of scholarship, presented in Table I.4 below, reflects novel approaches to the efforts aimed at achieving effective learning. Moreover, running contrary to widely held notions, all of these activities also have the potential to aid scholars in enhancing their reputation.

Table I.4: The scholarship of teaching

Designing a course/learning programme
Producing and delivering a teacher focussed, face-to-face, institution-based, often access controlled course/ learning programme
Co-producing and co-teaching a teacher focussed, face-to-face, institution-based, often access controlled course/learning programme
Producing and delivering a teacher focussed, online, institution-based, either access controlled or freely accessible course/ learning programme
Co-producing and co-teaching a teacher focussed, online, institution-based, either access controlled or freely accessible course/ learning programme
Conducting a social networks based, participatory MOOC (massive open online course)
Pursuing the Open-Notebook Science model in the classroom
Tutoring/mentoring students on an individual basis
Advancing learning theory through classroom research

A more in depth exploration of the potential reputational benefits of engaging in the scholarship of teaching (see Table I.11 in the Annex as well as the aforementioned D2 – Interim report) shows them all to be rewarding for the scholars. First of all, if and when teaching is approached, as Boyer (1990) suggests, in a manner similar to research-focussed undertakings, as a disciplinary- and pedagogical-knowledge based and peer-authorised enterprise, the outcomes can certainly aid scholars in their quest for prestige. After all, scholars would surely report the results of their efforts in the form of a scholarly publication, which, just like any other report of a research undertaking, can afford expert achievements-based eligibility for peer and student recognition and esteem.

Also, here too, the affordances of Open Science 2.0 seem to bring about considerable changes, enabling as they do the above-noted shift to learner-centred, qualitatively different, open and participatory practices of teaching, which break out of the confines of the four walls of the classroom to reach multiple and diverse audiences. Thus, the ubiquitous access to an unprecedented wealth of digitised learning resources, brought about by the adoption of Open Educational Resources (OER) policies by a wide variety of governmental, institutional and philanthropic organisations (Veletsianos and Kimmons, 2012) is further bolstered by the increasingly more prevalent practice of creating open courses and/or making openly available course materials to the public, as well as the many, social-media afforded networked spaces that invite participatory engagement in learning (Veletsianos, 2010). All this can go a long way towards furthering scholarly reputation building, too, with the opportunities thus provided for attaining unprecedented online scholarly and public visibility, for gaining peer and public recognition, for advancing social networking and for enhancing one's digital identity.

These developments are best exemplified by MOOCs (massive open online courses). In point of fact, these social networks based, crowd-sourcing technologies enabled, participatory online courses demonstrate most eloquently the potential of scholarly teaching, possibly for meaningful pedagogical achievements (Daniel, 2012), although this is seen as controversial (Bates, 2012), but certainly for reputation building. As Daniel (2012) contends, the real revolution of MOOCs is that they can achieve Boyer's (1990) purpose of encouraging the emergence of a scholarship of teaching alongside the scholarships of discovery (research), integration and application. This, because placing their MOOCs in the public domain for a worldwide audience will oblige institutions to do more than pay lip service to the importance of teaching and put it at the core of their missions. If so, scholars conducting MOOCs stand to gain twice: their teaching achievements will be taken into consideration, whilst the massive, globe-spanning visibility, which is an inherent feature of MOOCs, will contribute significantly to their scholarly and public visibility driven prestige.

The scholarship of co-creation

Taking the notions driving much of the current discourse on the nature of contemporary scholarship one step further, Garnett and Ecclesfield (2011) update Boyer's (1990) model by proposing the addition of a fifth dimension, the scholarship of co-creation. This, because, as they contend, Boyer's framework, which considers research and teaching as two distinct spheres of activity, and sees the producing of knowledge as a linear process, no longer accurately reflects today's increasingly converging processes of knowledge discovery and knowledge transmission and the resultant blurring of the distinction between the roles of researcher and teacher.

Indeed, the delineation of the activities that can be seen as comprising the scholarship of co-creation, presented in Table I.5 below, demonstrates that in these digital days of Web 2.0-facilitated Open Science 2.0, the collaborative discovery of new knowledge and the processes of participatory learning intertwine at times to form a whole. Perhaps not very surprisingly then, for scholars' various activities in the course of both their research and teaching undertakings all have been found in the analysis of the pertinent literature to have reputation-accruing goals and potentials, co-creative activities, too, can be very beneficial indeed for enhancing scholarly standing and prestige (for the reputation enhancing goals and potentials of co-creative work practices see

Table I.12 in the Annex; for an in-depth discussion of the topic see the aforementioned D2 – Interim report).

Table I.5: The scholarship of co-creation

Participating as a consultant in a PPSR (public participation in scientific research) project Leading a Contributory PPSR (public participation in scientific research) project Leading a Collaborative PPSR (public participation in scientific research) project Collaborating in a Co-Created PPSR (public participation in scientific research) project Conducting a PPSR (public participation in scientific research) project in the classroom or in a web based course/learning programme

Arguably the most obvious instances of co-creation can be seen in the increasingly widespread trend of public participation in scientific research (PPSR). Defined as intentional collaborative endeavours between science researchers and public participants – including but not limited to amateur experts, concerned community members, scientists trained in other fields, and/or school students – PPSR projects set out to generate new, science-based knowledge to address real-world problems (Shirk et al. 2012). Best known and commonly referred to as citizen science projects, PPSR projects can be seen as following three models, according to the varying degrees of public participation in the scientific research process: contributory, collaborative and co-created (Bonney et al. 2009).

A Contributory PPSR project is typically designed and led by scientists, with members of the public primarily contributing data. A Collaborative PPSR project, also referred to as a community involvement/adaptive citizen science/adaptive co-management research project, is typically designed and led by scientists, with members of the public contributing data but also helping to refine project design, analyse data and disseminate findings. A Co-Created PPSR project, also referred to as a participatory/participatory action research project, is typically designed by scientists and members of the public working together, with the public participants actively involved in most or all aspects of the research process. Admittedly yielding somewhat differing outcomes (for a detailed comparison see Shirk et al., 2012), the three models nevertheless share both scholarship-promoting capabilities and a strong reputation building capacity.

Looking at these co-creative activities from the specific angle of reputation building demonstrates their strengths in this area, too. PPSR projects, inviting as they do amateur experts and informed citizens to join the scholarly net, can bring about increased visibility for the scholar. No less importantly, the fact that such projects yield both formally structured, conventional scientific papers and societal publications, serves to accrue for the scholar both scientific-achievements based eligibility for peer recognition and esteem and societal impact, which can enhance scientific prestige, too.

Additional reputation enhancing achievements

Two additional components in a scholar's daily activities, plainly important, if, perhaps, not strictly definable as scholarly, are also seen as potentially reputation enhancing: success in obtaining external funding and holding academic managerial leadership positions.

The acquisition of funding is one of the most widely used quantitative indicators of excellence in research performance (Laudel, 2005; Van Arensbergen, 2014a). In fact, the notion of performance-based funding of research is so widely endorsed in academia that it is now used in virtually all evaluations at the level of the individual faculty member, the department and the university (Laudel, 2005; Meek and Van der Lee, 2005). This, on the assumption that in our era of scarce

resources grants are awarded to the best researchers, as a means of ensuring cost-effectiveness: the production of the best research possible with the available money (Heinze, 2008; Laudel, 2006).

With the obtaining of external funding having thus become a significant gauge of scholarly distinction, it is hardly surprising to find that grants provide academics not only with financial resources to conduct research but also with academic prestige and the ensuing further career opportunities (Bloch et al., 2014a; Bloch et al., 2014b; Van Arensbergen, 2014b). As it might be expected: as Laudel (2005) notes, the decision of a grant-giving agency to fund a research, based as it is on peer review, represents a vote of confidence in a scholar by his/her peers, and, of course, the more competitive the grant, and the more rigorous the peer review system of the funding agency, the higher it is weighted. Indeed, studies spanning the past two decades attest to the importance accorded in academe to the acquisition of research grants as a measure of successful research performance, which, therefore, is inevitably rendered a reputation enhancing achievement (Monahan, 1993; Boyer and Cockriel, 2001; Walden and Bryan, 2010).

However, a good scholarly reputation is not only the coveted potential outcome of securing research funding; it is also its prerequisite. With all that the most important criteria for judging a research proposal are the characteristics of the project itself, i.e., its quality and feasibility, it is not only the quality of the project that is assessed, but the whole of a scientist's former research (Laudel, 2005). Justifiably so, for the relatively brief research proposal is not always a sufficient basis for judging the quality of future work. Indeed, as a host of studies cited by Van Arensbergen et al. (2014a) amply prove, the academic status of applicants and the status of their department, university, or institute play an eminent role in grant-evaluation processes.

This state of affairs brings about the Matthew effect in external funding (Gillett, 1991; Laudel, 2005, 2006). With a scholar's track-record-based reputation deemed instrumental in achieving a proposal's success, grant-seekers need to have conducted prior projects that led to publications; this, in turn, depends on funding. Thus, those who get the most external funding are likely to get even more while others are crowded out of the system. Here, too, the rich do indeed get richer, and the poor – even poorer.

In light of all of the above, it is perhaps understandable that for quite some time now the rigorous directives of the 'publish-or-perish' mentality in academe have been joined by the no less compelling behavioural rules stemming from the distinct, if closely interconnected ideology of 'get-grants-or-perish' (Vannini, 2006). To be sure, applying for external research funding has become one of the major activities carried out routinely by scholars at universities (Zhao, 2010). Of course it has: not only is there mounting pressure on faculty to procure external research revenue for their departments and institutions in these days of declining monetary support of public universities (Musambira et al., 2012), but in this case the individual researcher's interests are wholly aligned with those of the university. Grant acquisition both secures the necessary funds for a researcher to conduct their research or do it well and allows for reaping the aforementioned considerable individual and institutional reputational benefits it confers.

Another factor that from a prestige-conferring perspective is widely seen as important is holding academic managerial positions. True, given the research achievements steered value and reward systems of academe, a scholar's standing is based to a considerable extent on their research and impact on the field, as determined by experts in that field (Dewett and Denisi, 2004; Hagstrom, 1965; Merton, 1973; Storer, 1966). However, the scholar’s world, as Agre (2000) points out, has a matrix structure: on one axis are the campuses and on the other axis are the disciplinary communities. Both are important enablers of the scholarly endeavour: the university provides the administrative apparatus and physical plant, and, perhaps most importantly, the income-secured 'safe seat' for scientific work. At the same time, the disciplinary circle of colleagues directly facilitates its prime purpose, the achievement of new knowledge via the intertwined processes of

the continuous exchange and evaluation of ideas. No wonder then that it is commonly held that holding managerial/leadership/headship positions in a Higher Education institution (vice-chancellor or rector, dean, head of department, etc.) can go a long way, too, towards enhancing a scholar's prestige among their peers.

Perhaps not very surprisingly, for, as Kekale (2003) suggests, managerial leadership constitutes a very strong source of personal power, influence and respect. This was true even while the academic manager was seen as 'first among equals'; it must be all the more so now that higher education institutes have undergone a transformation from collegial communities of academics into organisations with a hierarchy, where the manager is expected to act as employer (Musselin, 2007). After all, academic managers are in charge of the allocation of resources and serve on the important academic committees, so that they can hinder or help the pursuit of the scholarly activities of the faculty in many ways (Kekale, 2003; Kogan, 2007). No less crucially, according to Moodie and Eustace (1974), their relations with their colleagues constitute a significant source of leverage, seeing that all faculty appointments and promotions are initiated by them and necessitate their positive recommendation; all grant applications submitted need their formal and informal support; all projects undertaken require their backing within and without the academic institute.

Thus, academic managers can become greatly visible and well-known figures, certainly in their own institutions, but very possibly outside of it, too. In result, they are more likely to be invited to hold offices in professional organisations, serve on committees, and undertake all manner of public-spirited tasks, all of which may serve still further to increase their prestige. Add to this that they will normally have been appointed to a leadership role in virtue of their superior scholarly achievements and professional competence, and it becomes almost self-evident why their managerial roles serve to enhance their reputation (Moodie and Eustace, 1974).

Given this state of affairs it is surprising to find that there seems to be no empiric evidence directly supporting the prestige-conferring capabilities of academic managerial positions, with all that it is almost in the nature of a truism. Take, for example, a recent study into the extent to which the leadership of higher education is seen as a universally positive or contingent experience (O'Connor et al., 2014). The study finds these to have considerable attractions, but enhanced prestige is not specifically numbered among them. Perhaps it is such a patently obvious notion that it needs no proof?

2.1.3 Conclusions

This literature-based comprehensive, analytical exploration of the work-life of scholars (in the widest sense of the term), which had set out to construct the conceptual framework for the study of emerging reputation mechanisms for scholars, yielded a schema of their various, traditional and novel, offline and online activities. Focussing on the reputation building, maintaining and enhancing components of the activities identified and categorised, the scholarly undertaking has been found to be potentially very well-supported indeed in our present-day era of Open Science 2.0, but, at the same time, to be facing more challenges, too.

Take, for example, the greater visibility afforded by transparent and open practices. First and foremost, perhaps, it can lead to scientific-achievements based eligibility for scholarly recognition and esteem, with all its crucial importance for career-related rewards and further work opportunities. Concurrently, the opening of the processes of the scholarly endeavour to the scrutiny of public collaborators and audiences can contribute significantly to the achieving of public visibility and societal impact, both of which can enhance scholarly prestige, too. However, with all their obvious advantages for reputation building, Open Science 2.0 afforded open and participatory practices may occasionally prove to be a two-edged sword for the scholar. This is perhaps best exemplified in those instances where the activity cannot be readily translated into conventional

research outputs, most notably journal articles, as it sometimes seems to be in integrative or application-oriented projects, especially citizen science ones. The price to be paid for participating in novel scholarly undertakings may then arguably be seen as too high, a state of affairs that is nowhere more evident than in the case of teaching: with all that creating open courses and/or making openly available course materials to the public can have considerable potential for enhancing a scholar's standing, it is not often considered a reputation building activity.

It is, therefore, in the context of the changes characterising today's scholarly scene, where the scholar is faced with strong incentives to embrace open and participatory ways and means of working, at the same time that these question some of the traditionally held elements of the scholarly practice, that the forthcoming stages of study needed to establish how today's digital scholars actually construct, sustain and enhance their standing and reputation.

2.2 State-of-the-art mapping of reputational platforms

2.2.1 Methodology

The aim of this phase of the study was to scope online platforms that accommodate 'new' types of reputational mechanisms for scholars in order to determine:

- what type of scholarly activities these platforms support;
- how reputation is constructed within these platforms.

The expectation was that a mapping of the reputational platforms against the conceptual framework developed in Section 2.1 would reveal which areas of researchers' tasks are covered by these platforms and also reveal potential gaps and biases. For example, are all the activities measurable in online environments; how reliable are the scores and how are they influenced?
Criteria for platform selection:

- Do they provide novel online tools and social networking services (SNSs) used by scholars to perform their scholarly activities?
- Are they relevant to, available for, and used in at least four EU countries?
- Are they specifically built for researchers or consider researchers an important user group (e.g., LinkedIn)?

General services, such as Facebook, although possibly used by academics in some contexts, were excluded as they are not specifically built for scholars and it would be very difficult to distinguish social and scholarly use. The other reason for their non-inclusion is that building reputation and measuring reputation are two different things. Some services might help you improve your reputation, but they do not have any mechanism to measure your reputation as they do not provide any data, scores, etc. Conventional measurements-based services, such as Google Scholar, were not included either, as they rely solely on citation-based metrics.

2.2.2 Population of reputational platforms

More than 40 websites were initially identified as possibly having some potential for our purposes, and finally a representative and a very varied selection of 25 services (representing 13 different platform types) were chosen (See Annex 2 for the full list). A tentative list of the types of platform follows:

1. Altmetrics[7] services: *Kudos,*[8] *Impactstory.*
2. Citizen Science platforms: *FoldIt, Socientize.*

[7] Altmetrics are non-traditional, article level metrics thought of as an alternative or supplement to more traditional citation impact metrics, such as the impact factor and the *h*-index. Altmetrics includes mentions in the social media as well as downloads.

[8] Kudos, while using altmetrics on their platform, see themselves as being an 'outreach' platform.

3. Code repositories: *GitHub.*
4. Data repositories: *Dryad.*
5. Discipline specific academic social networking services; *BiomedExperts, Epernicus, myExperiment, Scitable.*
6. Electronic laboratory notebooks: *Labfolder.*
7. Multidisciplinary academic social networking services: *Academia, Academici, LabRoots, MyNetResearch, MyScienceWork, Profology, ResearchGate.*
8. Open Peer review systems: *Peer Evaluation.*
9. Professional social networking services: *LinkedIn.*
10. Q & A Sites: *Stack Overflow.*
11. Reference management tools with social media features: *BibSonomy, Mendeley.*
12. Review systems for MOOCs: *CourseTalk.*
13. Social learning platforms: *Edmodo.*

Mapping and evaluation

For each of the 25 case studies the evaluation included:

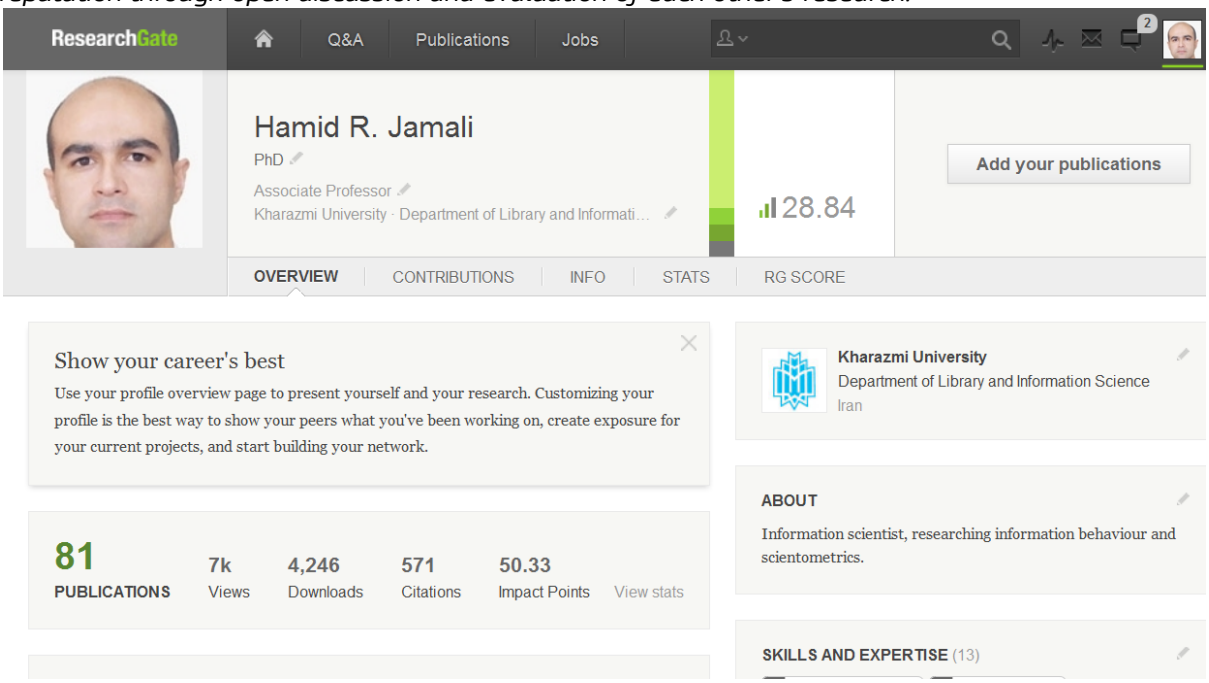
- Introduction/history/function;
- Screenshot;
- Factsheet;
- List of scholarly activities covered (mapping);
- Review of research on the service;
- Scores, statistics and data provided by the service that might help build/showcase reputation.

Table I.6: ResearchGate

The example of ResearchGate follows in order to demonstrate the detailed nature of the evaluation:

Introduction

ResearchGate (screenshot below) is a social network launched in 2008, which has over 5 million users. It is based in Germany and its stated mission is *to connect researchers and make it easy for them to share, discover, use, and distribute findings. We help researchers' voice feedback and build reputation through open discussion and evaluation of each other's research.*



Factsheet

URL	www.researchgate.net
Launched	2008
Country	Germany
Owner	ResearchGate
Created by	Ijad Madisch, Sören Hofmayer, Horst Fickenscher
Number of members	5.5 million
Number of countries	193
Number of publications	67 million
Number of full-text pubs	14 million
Alexa Ranking (Sept 2014)	2,592
Type of site	Multidisciplinary academic social networking service
Purpose	Sharing pubs, collaborating, connecting with colleagues, Q & A, Finding jobs
Target audience	Researchers/mainly academics
Type of research	All
Research areas	All
Language	English
Membership	Free

Scholarly activities covered

a) Research

- R4. Requesting/providing help in locating research literature

Publications, sharing, and bookmarking features enable finding & sharing literature

- R9. Releasing data to the scholarly community

Allows sharing different types of content which can be used to share data (e.g. as Excel file)

- R10. Releasing methodologies, research tools and protocols to the scholarly community

Allows sharing different types of content which could be used to share research tools or protocols

- R11. Releasing laboratory notebooks to the scholarly community

Allows sharing different types of content which could be used to share lab notebooks

- R12. Keeping up with new developments

Monitoring feature helps users keep up with new publications and events

- R13. Getting help for solving topical problems

Q & A feature helps users do this

- R14. Disseminating research results formally via traditional scholarly channels

Publication and sharing features can be used to list publications in traditional channels and disseminate them by uploading full-text; site gives citation & download statistics

- R15. Disseminating research results formally via Open Access scholarly channels

Publication and sharing features can be used to list publications in OA channels and disseminate them by uploading full-text; the site gives citation and download statistics

- R16. Disseminating research results formally via enhanced Open Access scholarly channels

Publication and sharing features can be used to list publications in OA channels and disseminate them by uploading full-text; the site gives citation and download statistics

- R17. Disseminating research results informally via active participation in conferences

Publication and sharing features can be used to list conference presentations and disseminate them by uploading full-text; the site gives citation and download statistics

- R18. Disseminating research results informally via repositories/websites

Users can upload full-text of their publications including published or preprints on RG; gives citation and download statistics

- R20. Disseminating research results, ideas and opinions informally via scholarly social networking sites

Publication and sharing features can be used for this purpose; gives citation and download statistics

- R23. Participating in open peer reviewing

Has recently added Open Review feature that could be used for this purpose

- R24. Monitoring one's impacts

RG statistics and scores show impact of researchers

b) Application

- A8. Serving industry or government as an external consultant
- Profile feature allows users to list their experience and skills and show services to industry and government
- A9. Serving one's professional/disciplinary community

Profile feature allows users to list experience and skills and show services to professional community

c) Integration

- I10. Producing Open Education Resources (OER)

Sharing feature allows users to upload and share different types of content (e.g. PowerPoints) and this helps users to share freely on the web one's educational resources for everyone to use and reuse

Scores, statistics and data provided

- Publications
- Number of publications by type (articles, conference papers etc.)
- Number of publication views by country & by institution, daily, weekly, and total
- Number of full-text downloads daily, weekly, and total
- Number of dataset downloads daily, weekly, and total
- Number of full-text requests last week, and total
- Number of Google referrals (for publications) daily, weekly
- Number of Open Reviews
- Number of Citations
- Impact Points (aggregate of IF values of one's publications)
- Profile
- Number of profile views by country & by institution, daily, weekly, and total
- Number of Google referrals (for profiles) daily, weekly
- Number of questions
- Number of answers
- Number of Followers
- Number of Projects
- RG Score (a score with a secret algorithm that is based on how other researchers interact with one's content, how often, and who they are).
- Global Institution Ranking based on different statistics of RG Score and Impact Point

2.2.3 Outcomes

The case studies showed that of the 58 different scholarly activities identified by this study, the platforms support 27 (less than half) of them in regard to providing reputation building, maintaining and showcasing opportunities. Out of these, the large majority (16) relate to research activities. Other activities supported included:

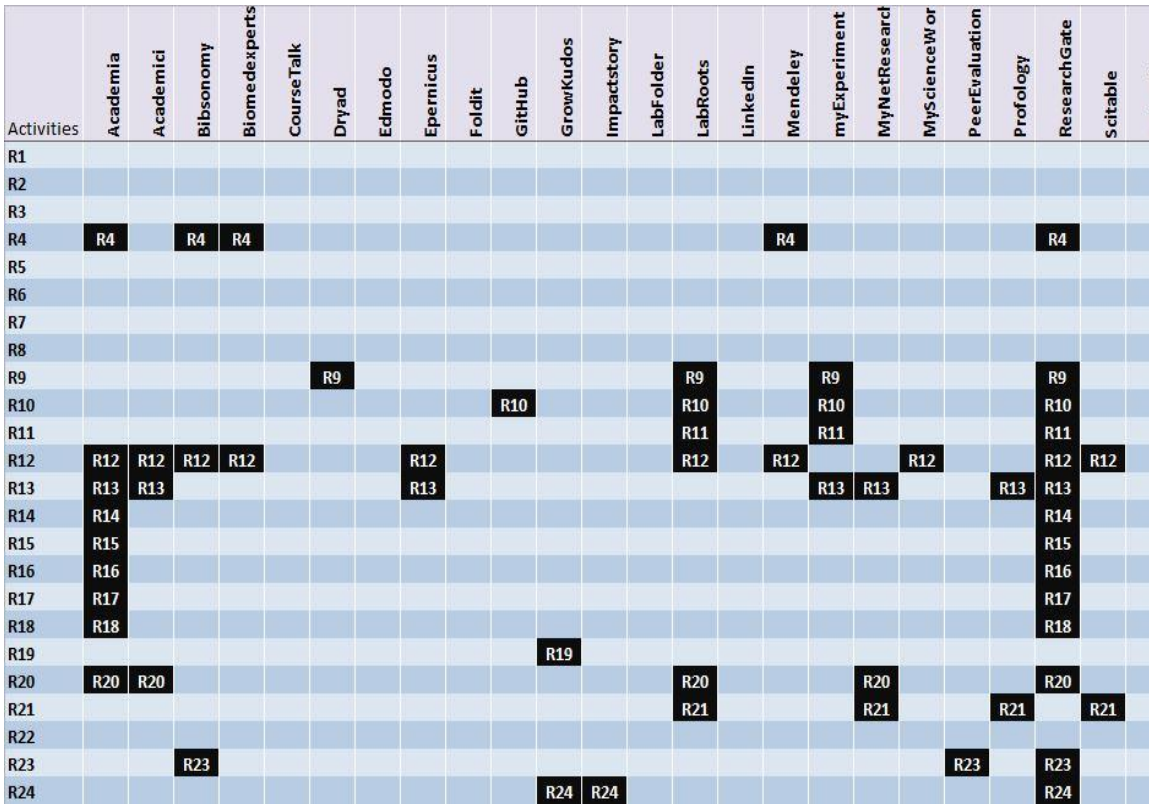
- 3 teaching activities;
- 2 application activities;
- 1 integration activity;
- 5 co-creation activities.

This means that for the area of scholarship of research, 16 out of 24 activities were supported by the observed platforms. Most activities related to *releasing and disseminating research outputs* are well-supported (see Figure 1).

In the case of teaching, 3 out of 9 activities were supported. Activities related to *monitor and evaluate the quality and effectiveness of the learning experience* were supported. For application, 2 out of 10 activities were supported, including those related to *serving industry or government, or one's professional/disciplinary community.* In integration only 1 out of 10 activities were supported, which was *sharing freely on the web one's educational resources.* In co-creation, all 5 activities were supported by citizen science platforms.

Note that when mapping cases against the conceptual framework it was decided that just supporting a scholarly activity was insufficient for it to be mapped, for that it should also support the reputational measurement of the scholarly activity. For example, take this teaching activity: "Conducting a social network based, participatory MOOC". The reputational purpose of this activity is "achieving massive online scholarly and public visibility; reaching multiple and diverse audiences; gaining peer and public recognition; advancing social networking; enhancing digital identity". The fit for purpose requirement for a reputational mechanism is "participation based public and peer monitoring and evaluation of the quality, effectiveness and explicit and implicit impact of the learning experience". Edmodo, for instance, supports the scholarly activity, as the activity is to offer a course online and on Edmodo you can run a course, but it does not support the reputational purpose because the purpose is participatory monitoring and evaluation of the quality and there is no rating or review or monitoring on Edmodo. CourseTalk is the opposite, you cannot offer a course, but you can review and monitor courses.

Figure I.1: Mapping research activities to features of reputational platforms



2.2.4 Conclusions

There is a wide range of platforms that support scholarly activities although not many have features to help reputation building. For example, although there is the potential, many sites do not provide suitable data, scores, or statistics on scholarly activities.

The 'market' is in its infancy and hence fragmented. To find out about one's scholarly reputation it would be necessary to look at about 10 platforms and still not get a comprehensive picture. ResearchGate is probably the most comprehensive platform in terms of the subject area it covers and the range of features it has. It supports research output, web interactions and so on. But in terms of the range of research outputs Impactstory supports metrics for a wider range of outputs. However, Impactstory only employs third party data and provides metrics based on them. ResearchGate probably offers the most innovative service from a reputational point of view; its RG score reduces this to a simple and dynamic number.

There is clearly a bias on the part of platforms towards activities in the area of scholarship of research and in research on showcasing and dissemination. This, because the area of research is where most scholars obtain their reputation. This part of the market is quite mature with plenty of competition driving innovation. It is also big, but perhaps usage numbers are inflated by the popularity of sharing documents. Thus, user numbers for ResearchGate are more than 5 million and Academia.edu 18 million.

Teaching as a major activity of scholars (and also application) is neglected in current services and platforms. More services, such as CourseTalk, are needed to review and rate courses and lecturers. Such practices are still taboo in many countries, but seemingly not so much in the USA, where there are relevant services. One suggestion would be to provide academic genealogy (a few sites provide this) to see who has been whose student and develop scores based on this; for instance, by quantifying and measuring how influential an academic is by number of students supervised and by how important/influential those students are now and so on.

There are also other important outputs (e.g. patents) for which data exist in some national databases (e.g., US Patents) and you would expect them to be included, but there is in fact little data on them.

Various parties need to take action to improve the whole system. Data holders need to be more cooperative in giving data to services for this purpose (such as patent registration offices, universities, research funders) but for some of those that run current services reputation is a secondary consideration.

Finally, few platforms offer anything to the new actors, most are aimed at professional researchers and academics, except citizen science platforms, such as Socientize, which enable participation of the general public.

2.3 Case studies on scholarly reputation

The in-depth case studies are used primarily to answer the research question *how do new and emerging reputation mechanisms in the field of science work from the researchers', institutions' and platform's point of view*. One of the case studies is a scholarly reputation platform called KUDOS, and the rest are focus group interviews conducted with scholars in Poland, Spain, France and Switzerland. The specific research key questions asked are:

1. Who are the key actors and stakeholders?

2. What are the practices, motivations and experiences of individuals/institutions using these new emerging reputation mechanisms?
3. What challenges do they face?
4. What do they obtain from using them (e.g., work-related vs. social gain)?
5. How are such issues as trust, privacy and risk managed and regulated by the stakeholders both through technical and non-technical means?
6. What are the skills and attributes needed by individuals to participate in these platforms and what resources are drawn upon to support use?
7. What is the relationship between new reputation mechanisms and prospects for future success?
8. What new indicators could be used to measure impact and importance of researcher activities in a more granular, transparent and comprehensive way?

2.3.1 Reputational platform case study: Kudos

Interviews were the main means of obtaining information from this small company and 3 senior staff were interviewed. Internal, confidential reports and marketing data were also shared. A questionnaire was used to obtain the opinions of Kudos users.

Background

Kudos, based in the UK, has more than 30,000 scholars registered from around the world although the majority are Europeans and Americans, and numbers are increasing by about 1000 a week, which makes it a relatively young and small platform by comparison, for instance, with ResearchGate and Academia.edu.

Kudos adopts a different approach to that taken by the other platforms: it works with publishers to increase the use and impact of the peer reviewed journal article. It effectively helps showcase and promote the journal article, with the author (and publisher) doing most of the work. It helps researchers utilise their personal networks via social media for effective outreach together with tools that enable authors to explain their work to broaden readership potential and enhance search engine retrieval of their work. A dashboard then enables the researcher to monitor and the impact of these activities against a range of metrics (publication views/citations/downloads, click-throughs from sharing, and altmetric data). Kudos probably can be best described as a hybrid service combining the best of the old and new in the way of reputation. In the main, Kudos services three scholarly activities: 1) Disseminating research results informally via social media and email; 2) Explaining dense technical information in lay language to make it easier to understand/find; and 3) Monitoring a scholar's impact.

How then does Kudos help build/maintain/showcase scholarly reputation? Interestingly, they do not employ the term 'reputation' in their publicity; they use instead assessment, impact and 'ego system', but these are, of course, component parts of reputation. They recognise that reputation means more to academics than any other professional group and this is their direction of travel.

As a platform Kudos is very much involved in the 'building' side of things as the name of their web site indicates. Their ambition is to build a dataset of activities linked to impact that can help provide tool-based guidance to an individual researcher on what to do to improve their performance. This will be shaped to their discipline, career stage, country of origin and so on. It's not Kudos's intention to dictate what success represents; rather to provide a range of metrics and guideline that empower researchers to decide for themselves on the outcomes and level of performance that matters to them and to use tools to help achieve this.

Journal articles have a disadvantage that Kudos helps overcome, which is that they are often outdated when they are published because of the sheer length of the process in getting published, and even when published their contents obsolesce quickly, especially so in scientific fields. So Kudos provides the opportunities to update/refresh articles, annotate them with 'after the fact' data, stimulate more use and maintain the 'conversation' which they started. They also argue that this will re-invigorate older and related publications with social media tools.

Similarly, they are really interested in what happens in-between publications. Research, of course, does not stop. In-between researchers are updating blogs, producing and giving presentations. Kudos argue why should these scholarly activities not also be shared and discussed; why should they not also be an important part in assessing an individual researcher's reputation? More visibility for these activities would help shape and refine a researcher's ideas and improve them before the main act of publication and Kudos are keen to find ways to facilitate that. Related to this is helping researchers update historic publications. Authors have said they use Kudos to keep articles they may have published several years ago up to date by linking new resources to past articles, then sharing these to stimulate discussion on the meaning/relevance of their original piece of work. This is a good example of the symbiosis between the social and the formal scholarly environments. Kudos are also conscious of the way that the new virtual scholars like snacking on small bits of data; want it on demand so big chunks of content, such as articles, are not sufficient; hence the need for summaries and impact statements, at which they hope to excel.

Key actors and stakeholders

There are principally two groups: 1) academics who have a huge appetite for all things reputational; 2) publishers, who clearly have a vested interest. In regard to academics, not all academics are currently targeted, but mainly senior researchers who are authors – quite an exclusive group. Around a third of users are professors. These are people who have publications worth enhancing and the time/resources to do it. Very few users are early career researchers because they do not have many articles to promote or not articles worth spending the time on. A small number of health care professionals, consultants, business/commercial professionals and government employees are users, but less than 5% in total. Users are mainly scientists, because they publish most journal articles and it also reflects the fact that they work with the big scientific, technical and medical (ST&M) publishers, whose authors use the service. Chemists feature most highly and are chief among the super users. Business and management are well represented, other social sciences much less so. Few humanities scholars are users, partly a result of the fact that journal articles are not their main research outputs, but this is changing. UK and USA are the sources of most users (40%), not surprisingly perhaps given that Kudos is an English Language service. China, India and Japan follow in numbers. So the EU is under-represented, something the country case studies hints at. It seems European scholars are behind the digital curve.

The other actors involved in the platform are publishers who, although not commonly thought of as stakeholders, but are clearly the original reputational stakeholders, are trying to regain their position by getting closer to the scholar. The Kudos initiative represents the publishers' move on what is clearly expected to be a big market, which is important to them given that they risk losing some of theirs, because of open access publishing and reputational platforms, such as ResearchGate, which offers articles once only available to subscribers, for free. Kudos is an unashamedly core academic reputational service and there are no signs of new actors in the Kudos membership.

Practices, motivations and experiences of individuals/institutions using Kudos

The motivation for Kudos is to maximise the impact of academics' key research outputs, journal articles, and to anticipate the (anticipated) requirement from funders/institutions/government for evidence that research has an impact and that researchers engage in knowledge transfer activities. The authors of articles use the platform to increase the impact of their articles and there is some

data, but not a lot, to suggest that this happens. Kudos believe that more can be done to raise the visibility, impact and usage of their work in a very crowded scholarly space and they think they will be effective in this regard.

Benefits scholars obtain from using Kudos

The prime benefit is enhanced and wider research reputation, largely by polishing the academic 'silver', journal articles. Boosting the use of articles published, even older ones. What they are doing is to maximise traditional outputs.

Kudos is also a toolbox which extends the readership of journal articles in terms of diversity. Diversity, because you can write key messages about a paper in simple language or in a more attractive way and that may attract people outside the scholars' area or expertise to read the paper. Thus, improving reputation within the existing paradigm, and so reinforcing it. Kudos also make the point that social/multimedia use is not yet widespread, so its potential as a communication channel has still to be explored and hence can really benefit author reputation by providing users with an 'edge'.

Challenges faced by Kudos and its users

The big challenges for Kudos are: a) keeping publishers on-board (in the face of strong competition from outside the industry and scholarly concerns about the motives of publishers); b) convincing academics to invest their time (it requires more of their time than other platforms); c) proving the activities they require academics to undertake leads to greater impact and greater performance in assessment exercises. For authors, the challenge is to find the time to invest in what is, after all, a demanding service, requiring much higher investment of their time. Even Kudos admit this. However, Kudos argue that authors are not publishing that many articles that it would be unrealistic for them to find some time to help increase the impact of each one. Most, they say, publish five or less, but five is not an inconsiderable number. They also argue that authors can spread the load across multiple authors, more so in science, of course. Their surveys tell them that authors are willing to self-promote themselves, but our user data tell us time is a big factor in the non-use of reputational mechanisms.

How is trust, privacy and risk managed and regulated both through technical and non-technical means?

The fact that Kudos works with established publishers makes them believe they are a trusted source. Kudos buys in the metric data so they cannot influence it in any way. It is acknowledged that it remains early days for altmetrics and that there are unethical practices, after all it is relatively easy to buy 'likes' and 'tweets'. They provide a dashboard of metrics to overcome the discrepancies and weaknesses of individual indicators and let the author make the judgment call.

Skills and attributes needed by users and support required

No special skills are needed, Kudos argue, just the fundamental ones of summarising and categorising information, but, as mentioned earlier, some effort has to be expended and authors have to keep it up as it's a continuous conversation which is being built. Commitment is then a big requirement. For the author Kudos might not require any special skills, but it requires considerably more in time and energy than other platforms. Kudos would argue that it's different in nature – other platforms provide metrics which authors only need to look at – hence little requirement for any actions on their part; Kudos is action-based by its very nature so requires some time.

Relationship between new reputation mechanisms and prospects for future success

A lot of the users of Kudos are senior and successful academics so they are probably more interested in tweaking their reputational record; grandstanding rather than seeing it as a vehicle for future success.

New indicators which could be used to measure impact and importance of researcher activities in a more granular, transparent and comprehensive way

Kudos believe that traditional impact measures, such as usage and citations, are 'distressed' and should be seen as part of a much bigger impact picture, including altmetrics. No new indicators are really available yet (although they are being worked on – especially in the area of impact); Kudos are simply offering a dashboard of measures instead. The longer term goal for Kudos is to draw in wider activities outside of publishing, addressing the so called 'esteem factors': editorial board membership, role as a reviewer, society posts, invites to speak at conferences, etc. Kudos will move scholars closer to being a more comprehensive reputational mechanism, touching more scholarly bases.

Conclusions

In terms of broad scenarios Kudos belongs to the 'Business as Usual Model'. It offers seamless change, improving on what works best for reputation in the traditional environment (journal articles) and embracing social media and other outreach channels to boost their use and widen their impact. The platform appeals to traditionalists and has little following from the young. They are not ushering in anything revolutionary (yet). They are not challenging the paradigm. Long term plans (see below) suggests a more revolutionary agenda for Kudos but, of course, this depends on whether: a) they can increase their user numbers significantly; b) publishers, their major stakeholders, allow them to change in the way they want to do. That is to depart from the outputs/metrics that publishers have traditionally been most interested in.

Conversely, it is possible that the Kudos initiative actually represents a major shift in the scholarly communication industry. There could be a bigger story here. It could be that publishers, albeit through a surrogate like Kudos, are going back to the old customs and alliances. Faced with the fact that open access publishing will mean that much, if not all, of their journal content, the diamonds in the mine, will be given away for free as funding bodies and policy makers force researchers to publish in OA journals, they have no other choice than return to their roots by getting closer to their authors and assist them in building/maintaining their scholarly reputation.

Currently Kudos only deal with reputation from a research perspective by creating greater visibility to article outputs, so boosting traditional reputational proxies (usage and citations). But they do see scholarly assessment shifting from the journals that researchers publish in to an assessment at a more granular level to do with the impact of the full range of the author's particular outputs. That might be a paper, book or, increasingly, other research outputs too, such as grey literature, datasets, videos and presentations. Slide shares are thought to be particularly attractive and they are said to generate lots of usage and publicity – the web is after all a visual medium. It is thought that the way in which impact will be measured will broaden: currently the impact factor represents average peer citations, but new metrics are evolving that give a much fuller picture of impact, such as policy improvement, changing practices, public engagement – things that funders in particular are interested in tracking. As these metrics become more widely used for research performance assessment, Kudos will assist researchers in understanding the full picture of their impact (by bringing all those metrics together into one place and allowing granular benchmarking) and help them increase their performance against the metrics that matter to them (sharing, explaining and enriching to increase discoverability and tracking the impact of these activities).

2.3.2 Country case studies

Countries were selected on the grounds that they offered diversity - a wide range of languages and population sizes. For all the country cases the host/hub institution was a university. In the cases of Spain and France more than one institution was involved. A representative sample of subject domains (physical science, computer science, humanities and social sciences) were distributed

among these countries (See Table I.7 below). In total, nine scholarly institutions were covered and around 95 people interviewed.[9]

Table I.7: Country case studies of scholars

Case study	Host institution (and satellites)	Subjects	Notes
France	***Université de Lyon 2/3*** (plus Gate CNRS, and Paris 9 Dauphine)	Economics scholars	Mixture of focus groups and interviews involving 15 scholars, 1 research manager and 1 librarian
Spain	University of Leon (plus University of Salamanca and CSIC)	Humanities scholars, plus a few social scientists from CSIC	Mixture of focus groups and interviews involving 46 people: 38 scholars, 2 deans, 1 head of International and Institutional Relations, 1 head of the Area for Research Support and 4 librarians.
Poland	University of Warsaw (plus Technical University of Warsaw)	Computer science scholars	Interviews with 24 scholars/consultants
Switzerland	Haute Ecole Spécialisée de Suisse Occidentale	Physical science scholars	Mixture of focus groups and interviews involving 9 scholars and 1 member of the rectorate

The key actors and stakeholders involved with emerging reputation platforms

In the case of the **French economists** featured in the study it is researchers who are the main stakeholders. As users, they are gaining more visibility and impact in their community and they are beginning to understand that what they are doing on the platforms is increasing their authority and reputation. Even though not all the researchers use the platforms with the same intensity, they all realise that "something is happening". That is why some of them are becoming "influencers", inviting colleagues onto the platforms and asking them to be active. Research managers and librarians appear not to be actors, more a case of being uninterested observers.

In the case of the **Spanish humanities scholars** covered, the main actors are researchers under the age of 55 with a specialism in fields, such as Prehistory and Medieval History, where journals are the main means of communication. Young researchers in the first stages of their careers are the ones that take more advantage of reputation mechanisms. Deans do not see the promotion of staff reputation as one of their responsibilities. They are more involved in managing their staff's teaching load. Individually Deans do not know much about these platforms.

Polish computer scientists offered the view that, in theory, the university and the state, the benefactors of grants, should be the key stakeholders, but in practice they do not seem to be involved at all. Polish universities, especially state-owned ones, are quite conservative when it comes to the implementation of information technology to assess the work of their academics. Professors of older age who participated in the interviews did not use social networking services. They have a reputation as a result of becoming a professor; they therefore do not care about their reputation as viewed from the perspective of social networks. They have enough university power in their hands and they do not need to look 'cool'. They are professors for life.

[9] Blanca Rodríguez-Bravo (Spain), Cherifa Boukacem (France), Tom Dobrowolski (Poland) and Stephanie Pouchot (Switzerland) led the research teams for the country case studies.

Logic might suggest that the key actors in Poland are the younger generation, but not necessarily so, because they tend to be conformists. They apply all the rules forced on them by university authorities, who, as we have heard, have no interest in reputational systems. Reputational systems are more important for computer professionals than for computer scientists because they need contacts, and half of the computer scientists interviewed also worked as consultants. Social networks for software developers are numerous. There are more than 20 well known ones. Most of these networks use trust and reputation as the key component of their systems (the most used are GitHub and Stack Overflow). Besides them, IT professionals benefit from global academic social networks. They use several, each for a different purpose (e.g., GitHub, Stack Overflow and Mendeley). LinkedIn is treated as a virtual business card.

For the **Swiss physicists** interviewed this is a hard question to answer, as reputational platforms are not used and anyway they feel the platforms do not have a very good reputation themselves. But in some instances (for example, the University of Geneva) institutions are beginning to get involved. But for now they seem very far away from the researchers' concerns and priorities, who all suffer from a lack of time.

Practices, motivations and experiences of individuals and institutions using emerging reputation mechanisms and platforms

For the **French economists** interviewed the new emerging mechanisms are becoming places that help them to construct a researcher's reputation, letting them showcase their research outputs. While platforms do not yet challenge traditional reputation mechanisms, they supplement such mechanisms, providing a continuous stream of content showcased by researchers. Platforms can help to promote one's opinion; however, conversely, reputation platforms can work against researchers when they fail to complete their profiles and/or don't show any regular activity, leaving an impression of vacuity.

Although ResearchGate (RG) type platforms are not yet taken into account by institutions or research assessment policies, they are implicitly accepted by the members of the French Economics community because they help build a wider, media-based reputation.

The practices and related motivations of platform users can be grouped into two categories: those with passive and active profiles. The passive profiles are embodied by researchers who see advantages in using the platforms, but do not feel confident and concerned enough to participate actively. They "consume" information and contents; they pick up some elements, but do not go deep. These researchers consider the platforms more as a resource, and they do not yet see the reputational potential they could gain from them. For instance, they find RG very effective for obtaining articles that they would otherwise have to pay for on a publisher platform. These researchers spend very little time on the platforms. For their reputation, they rely on more traditional mechanisms.

The active profiles are embodied by researchers who experiment with the platforms as a resource (they explain that they find content that they would not have been actively searching for), but mainly they use the platforms as a 'collective game' where they can play with members of their community (professional and academic) to gain visibility, esteem, recognition and reputation. These researchers are convinced that what is happening on these platforms contributes to a widening of their reputation. These researchers are connected regularly to platforms and spend time posting content, downloading publications, updating their accounts, exchanging messages, interacting, in a word. At the same time, they observe and try to understand what is done around them by other 'game' players.

For **Spanish humanities** scholars attending the focus groups their main motivation in regard to platform use is to get updated about publications in their fields and to communicate their new

research. Most are conscious that they use the reputation mechanisms very poorly. It is noteworthy that they almost never participate in any forum. Therefore, they use the repository functionality, but not the actual social network.

Polish computer scientists interviewed generally do not think or know that scholarly social networks have reputational mechanisms. They make their own decisions about trust and reputation of other people, mostly by reading their papers or by meeting them at conferences. Reputation is mainly associated with innovation. They have a typical consumer point of view, not wanting to explore these services in depth. They tend not to use one service, but many, lightly and for different purposes. They are typically promiscuous users and move very quickly on to new services. The most popular social networking site is a GitHub, and in second place is Stack Overflow. LinkedIn is used by all as a digital business card (for head-hunters mainly). Some interviewees make limited use of Mendeley as a tool for group work. ResearchGate is not popular, although departments have their profiles on it. University computer scientists who specialize in theoretical problems are very attached to the traditional university career patterns based on publications and the accumulation of degrees.

The impact of reputational services is much less than would be expected. Thus, the most popular activity for the interviewed Polish computer scientists on both ResearchGate and Academia.edu was simply maintaining a profile in case someone wanted to get in touch with them — suggesting that many researchers regard their profiles as a way to boost their professional presence online. After that, the most popular options involved posting content related to work, discovering related peers, tracking metrics and finding recommended research papers. These are tools that people are using to raise their profiles and become more discoverable, not community tools of social interaction.

The **Swiss physicists** interviewed have their own dedicated tools and do not seem interested in reputational mechanisms. Some of them are aware of the phenomenon, but they are waiting to see what transpires on this front.

Challenges faced in using reputational platforms

For the case study **French economists** the main reasons preventing researchers from using reputational platforms are a lack of time and availability. Researchers have very tight working schedules and find it difficult to find time to use these platforms "enough" or "fully". This situation holds true, even for researchers who are convinced of the usefulness and impact of these platforms. This serves to explain why certain functionalities and working mechanisms are not necessarily mastered by researchers, who, nevertheless, use these platforms regularly.

Another drawback to using reputational platforms for Economists lies in the fact that they do not carry the weight and authority of 'official' places where reputation and recognition can be gained, such as thematic international open archives, e.g. HAL. These places benefit from a sense of seniority and legitimacy, which leads researchers to favour them above reputational platforms. The latter platforms are therefore seen as secondary tools in the researcher's overall strategy to build his/her reputation.

The principal problem for **Spanish humanities researchers** spoken to is a lack of time. Academics at Spanish universities have to perform as lecturers as well as researchers; also as managers. This leaves little time for anything else.

For the **Polish computer scientists** interviewed the main problem associated with reputational systems is that the activities of scholars are broad and different in character. It is hard to find a common denominator to all these activities. Another problem is the immaturity of semantic systems. They tend to count and judge publications and do not count knowledge or impact. Another problem is that computer science is a highly competitive world, in which the disclosure of the

details of the research can be used by competitors; it is not an 'open' world. Global corporations have an obsession with secrecy, and few computer specialists have the confidence to speak about their work. Science is also a battle field, it is not just about sharing and cooperation. They also do not like the commercialization of science and believe that the new reputation systems are tools that very much do that.

It seems that it will be necessary for management to support **Swiss physicists** and help them to understand the way these tools function and can be exploited in research activities as well as for reputation. For the researchers, the challenge will be to change their practices.

Benefits obtained from using reputational systems (e.g., work-related vs. social gain)

Using reputational platforms enables the **French economists** interviewed to: a) extend their network and to have more connections with colleagues with whom they want to work and collaborate; b) have a better knowledge of the most reliable and valuable contacts and stakeholders in their research topics; c) find more efficiently information and contents on their research interests; d) attract the attention of their colleagues/contacts to their research topics, publications and interests; e) make their activity and their impact more visible to a larger audience and promote and give evidence (via publications, regularity of their activity, expertise, research projects) of their authority and reputation; f) be singled out by scientific editorial teams, scientific authorities and so on for jobs, collaborations, responsibilities; g) build up a dynamic digital identity they can control.

The big advantage of reputational platforms for all the **Spanish humanities scholars** interviewed is to have access to peers' publications and to share their work. Also, by using reputational mechanisms, scholars can get more cites of their publications. Most scholars reckon that they become more visible, more popular. The use of social functionalities is, however, quite limited.

For **Polish scholars** in the study it is a case of benefiting in both work-wise and socially. Science is more personal than we believe.

As we have heard, the **Swiss physicists** questioned do not really use reputational platforms, so clearly they do not see the benefits of use. However, sometimes they extend their network using these platforms, but the perceived benefits are extremely limited. On the contrary, they tend to view platform use negatively. Some even complain about the automatic emails they receive from ResearchGate and liken them to SPAM.

How are such issues as trust, privacy and risk managed and regulated by the stakeholders both through technical and non-technical means?

Trust was not an issue at all for the sample of **French economists.** Researchers were confident about what they were finding (information and contents) on the platforms. In the case of RG, they approved of the fact that only people with an institutional email address can have an account. This kind of "filter" seems to enable them to be more comfortable and trustful about people and contents they find on the platform. Risks were more connected with the fact of putting a post print on the platform, which might be a copyright issue. Some researchers clearly expressed their fear of being added to the black list of a publisher.

Most of the **Spanish scholars** interviewed are not worried about trust issues and have not reflected on them much.

Because the **Polish computer scientists** interviewed use academic social networks mainly for communication with their own group and among their own colleagues, and all sensitive information or materials are sent/conveyed exclusively by email or by phone, this is not a problem. Generally speaking they do not trust any of the computer networks with their information.

Skills, attributes and support needed

French economists interviewed sometimes found it difficult to understand the "social" meaning of certain actions on the reputational platforms. For example, on LinkedIn, researchers whose skills had been endorsed by a third party did not necessarily know if they should reciprocate the action. On RG, researchers who had recently published a study did not know if they were allowed to upload it on the platform. Questions surrounding account settings were also raised. These researchers learned to use these platforms on the job, with no specific training. They therefore do not necessarily master all the aspects needed to feel completely comfortable using these platforms. Other skills included:

- Speaking English, which is not straightforward for French researchers. All the systems are English language.
- Knowing and understanding what actually constitutes the reputation of the researcher and how to burnish it.
- Understanding, sharing and operating the values attached to the reputational platforms: sharing contents, answering messages and questions, sharing comments.
- Time management to ensure you keep up with what happens on the platforms and post regularly new, selected elements, related to their daily activity.

It is necessary to be confident with technology and many of the **Spanish humanities** scholars interviewed are. In addition, there is a need to be dedicated to research development. Some scholars are more oriented to teaching tasks and to cooperating with external bodies and these people lack the important attributes. None of the Spanish institutions have undertaken any promotion of reputational platforms and this might be needed, at least in the fields of Humanities and Social Sciences.

The main source of skills/knowledge for the **Polish computer scientists** interviewed is colleagues already using the same platforms – the early leaders.

For case study **Swiss physicists** it's more a question of time, awareness and appropriate tools than a question of skills: physicists use their own networks and tools, they surely have the abilities to use non-specialized academic platforms.

The relationship between new reputation mechanisms and prospects for future success?

All the French economists interviewed, who are active on the platforms, considered that there was a beneficial impact on their reputation. They knew that the platforms showcased elements of their researcher profile and they have been "Googled" as a result. When applying for a position, for a new job, for funding, for a research project and so on, the reputation gained from the platforms can confirm the relevance of the candidate and help them pass through the selection process more easily (and even more quickly) than others. That means that beyond the official CV, panel members can take into account the reputation obtained via the platforms and visible on the Web. Enhancing your visibility has to be good for reputation.

As Spanish humanities scholars' use of reputation mechanism increases, as surely it will, they should obtain more invitations to conferences and participate in networks or in projects, so helping career development. By using reputation platforms their work can get more cites and hence improve their future prospects.

For the Polish computer scientists interviewed it is difficult to say. They use social networks to determine the popularity of their topics and papers, but they do not connect with all the activities offered by the reputational mechanism. They are passive users who do not take full benefit of the system. The main reason for using the network is for communication and information, not building one's reputation.

New indicators which could be used to measure impact and importance of researchers' activities in a more granular, transparent and comprehensive way

In some ways this question is premature because most scholars have yet to fully engage with the entire range of indicators currently available. See below suggestions from:

- **France.** Indicators on teaching activities (especially in regard to Master and PhD students) should be considered. Especially indicators on PhD supervising activities, for instance, number of PhD and/or duration of the PhD.
- **Spain.** More than just journal publications need to be taken into account in reputational calculations, such as conferences participation, conference organization, participation in projects or nets, supervision of doctoral theses and successful funding outcomes. Scholars are actually worried about scores from the reputation platforms being used for evaluations since they have few controls over them. There needs to be more interaction between the system and the scholar.
- **Poland.** There are a variety of scholarly activities, but they are difficult to compare with each other. So academic life is based on the principle "publish or perish". Other activities/indicators are less important.
- **Switzerland.** Science sometimes needs time and some research projects do not produce visible results for years, especially in theoretical physics. On the other hand, it is hard to apply bibliometric indicators to some of the fields covered by this discipline (example. HEP, thousands of authors for a single paper). There is a real need to build new indicators.

Conclusions

Although it is already 6 years since ResearchGate was founded, the case studies suggest that it is still early and experimental days for reputational platforms among European academics. Researchers do not see emerging scholarly reputation platforms as being important tools for the management of their academic reputation. The fact that the best known system is LinkedIn, a tool for all professionals, not only academics, says much about the impact of emerging reputational scholarly platforms.

Knowledge about reputational services is scarce. Where they are used, they are used lightly and passively and for reasons other than reputation, but more as a resource for information sources. Leadership, guidance and support regarding reputational platforms do not appear to be forthcoming. Furthermore, data from reputational systems are not taken into account in assessment procedures. This seems odd because universities everywhere are pre-occupied with their image and national/global rank, and logically a Higher Education institution's standing depends to a considerable extent on the prestige of its employees, but somehow senior management have not taken this fact on-board.

There is only lukewarm support for teaching activities, with the exception of PhD supervision, to be counted as reputational activities; this is true for managerial work as well.

There are bright spots. Scholars are using the reputational systems and see they can raise their global profile, although not wholly engaged with them. In terms of disciplines, Polish computer scientists/professionals are among the big users and French economists probably the most thoughtful users. Younger scholars clearly have most to gain and have more knowledge about the systems.

2.3.3 Survey of Kudos users

A questionnaire was developed based on the conceptual framework and the first two phases of the study. The link to the online questionnaire hosted on SurveyMonkey was sent with an invitation email to users in October. What is presented here is the analysis of 251 responses from European respondents. Please note that in the following analyses all age comparisons are between two

groups of those under 40 and those 40 and above, and all country comparisons are between those countries with more than 25 respondents (for statistical reasons), which were the UK, Italy and Spain. The analyses follow the structure of the questionnaire. This was, of course, a study of users of reputational systems and is not strictly comparable with the Country case studies where non-users were also questioned, and, as we have seen, there are many of these.

The results of the study are published in some detail in Deliverable 4, here we only describe the main findings, which are:

- Traditional research related activities contribute the most to scholars' reputation, including conducting research, collaborating in research, taking part in multidisciplinary projects and disseminating results in journals.
- Activities contributing the least to a scholarly reputation are dissemination of research via blogging/tweeting, administration and management and dissemination of research via social networking and citizen science projects.
- There are, however, statistically significant differences between communities of scholars:
    - Female scholars are more in favour of the new dissemination channels and media (social networking, blogging, open educational resources) and are also more in favour of conferences, administration and management and multidisciplinary projects counting towards reputation, as compared to men.
    - Younger scholars (under 40) consider serving one's community, the production of literature reviews and textbooks, and the production of open educational resources to be more important for their careers than older scholars. On the other hand, older scholars think the popularization of science activities should be rated more highly.
    - Social scientists say that using new media (social networks, blogs) for dissemination of research, serving one's community, citizen science projects, consultancy for industry and government, and conducting application oriented projects contribute more to their reputation than scholars from other subjects.
- Kudos users were asked about the attitudes their institutions/employers have towards scholarly activities and how they differ from theirs, and there are differences. The importance of administration and management is regarded more highly by the institutions. There is another difference, institutions do not value dissemination of research via blogging and social networks as much as scholars.
- Again there are differences in attitude between communities of scholars:
    - Female scholars say their employers regard dissemination of research via blogging and social networks to be more important than men.
    - Younger scholars say employers regard conducting research to be more important in assessing their performance. On the other hand, older scholars believe that administration and management is more important for employers.
    - While social scientists think that their institutions value peer reviewing and dissemination via social networks more than other disciplines, life scientists believe that production of literature reviews and textbooks is valued more by institutions compared to other scientists.
    - British scientists (compared to Spanish and Italian) believe that their institutions place more importance on disseminating research results via journal articles/books, conferences, peer reviewing, serving one's community; and also to the popularising of scholarship.
- ResearchGate, Google Scholar and LinkedIn are the most used platforms as, respectively, 77, 75 and 69% used them a lot or a little. Labroots, Impactstory and BiomedExperts were the least used reputational platforms with 96, 93 and 83% of respondents not aware of the services or

do not use them at all. Life scientists used ResearchGate the most and Arts & Humanities the least.

- A quarter of respondents think there are gaps/weaknesses in the web services used for scholarly reputation and, significantly, half of them did not know. The two most popular weaknesses are thought to be 'They're not trustworthy' and 'They are open to gaming'. Women were more likely to think that these two weaknesses exist.
- Around 45% of respondents disagreed with the idea of counting social media metrics towards one's reputation, while only 23.5% agreed with this idea. Those who agreed mainly did so on the grounds that they think social media helps scholars reach a wider and larger audience and disseminate their outputs more effectively. While the main reasons for those who disagreed were that social media activities and metrics are not relevant to scientific activities and they are also not credible or reliable.
- Respondents were more optimistic about the future importance of social media in career development.
- Slightly more than half of respondents believe that young scholars benefit more from social media than established scholars do and their main reasons are that the young are more comfortable with IT and are better at it and that they simply use them more and have more time to spend on social media. Those who disagree did so because they considered age to be an irrelevant factor. They also think that even in the case of emerging platforms, established scholars will have more visibility as they can showcase the works they have already done.

Overall, these results confirmed what we had learnt from in the country case studies. It is also interesting to compare these results with the recently released findings of the 'Science 2.0': Science in Transition project.[10] Thus, in this study 85% of respondents agreed or strongly agreed that Science 2.0 activities should be taken into account for researchers' career progression. This is rather more optimistic than our findings. Yet, illustrating the confusion or uncertainty of the respondents, another question, which asked 'What are the opportunities for 'Science 2.0' at the level of the individual scientist, found that enhancing career perspectives was thought to be the least likely outcome, with less than a quarter totally believing it to be the case. The clear opportunities were greater involvement in international networks and interdisciplinary research.

[10] http://scienceintransition.eu/

3. ANALYSIS OF THE IMPLICATIONS

The study was only ever envisaged to be exploratory. Its wide-ranging remit, limited resources and duration meant it could be nothing other than this. Therefore our conclusions and recommendations need to be viewed with this firmly in mind. While much has been learnt and much invaluable data collected, it cannot be argued that the study is definitive or complete. Its principal function was to feed timely information into a broader debate and wider evaluation of the whole scholarly reputational field. This we believe we have achieved and it is, as far as we are aware, the first comprehensive study to be published on the topic.

3.1 So what have we learned?

All the evidence points to the fact that, in Europe anyway, emerging scholarly reputational mechanisms and platforms have yet to make great headway in terms of take-up and impact. There is widespread use, but it is generally light, patchy and passive. Also, of what use that there is, much is associated with resource discovery and sharing rather than reputation building. Scholars are generally uninformed about reputational platforms, but there are pockets of creative and engaged use. Reputational platforms, more than five years on, are then far from being transformational. Still, there are now some big players on the global stage, what with Academia.edu boasting more than 18 million users and ResearchGate more than 5 million. This does represent progress and the field looks well positioned for a period of substantial growth.

There are a number of possible reasons for the limited and patchy take-up. Firstly, as the expert workshop concluded, just five years on, the market is still emerging and still in an experimental phase. Secondly, as this study has shown, none of the available platforms really come anywhere near to providing reputational building and maintenance opportunities for a comprehensive selection of scholarly activities. While participants in the expert workshop thought that this is not a bad thing in itself, because they were worried about monopolies forming and any one platform becoming too dominant, the country case study data certainly does not support their view. Scholars are time-poor and while they are quite happy to invest time on tried and proven reputation building methods, but not on novel, as yet not established ones and thus very unlikely to shop around. Thirdly, as the literature suggests and the country case studies found, there are few incentives for scholars to use emerging mechanisms, as senior management are either largely unaware of them or have decided to take a hands-off stance (leave it to the individual). It follows that they are not important in the crucial areas of assessment, tenure and promotion. The funders' voice, as best we can judge, is also quiet, preoccupied as they are with open access. Fourthly, many scholars are only just waking up to H-indexes and Impact Factors (CIS/CIBER, 2013), so they might not want to change focus, especially as Google Scholar, the purveyor of H-indexes and citation counts, is a very popular reputational platform indeed and very big opposition. But just maybe Google will jump ship, because surely they of all people see which way the wind is blowing and their views certainly should be sought. Fifthly, the country case studies and research elsewhere (CIS/CIBER, 2013) show there is a palpable sense of mistrust of the social media and what it might deliver in the way of metrics and that will stop a lot of scholars using reputational platforms, although the Kudos model of hitching them to conventional indicators might overcome some of the criticism.

Having said all this there are positives as well. Firstly, both the survey and focus groups found that despite patchy take-up, the majority of researchers thought reputational systems are here to stay and will become increasingly important, and especially so for younger researchers. Secondly, two of the, arguably, most pioneering and successful reputational mechanisms, ResearchGate and Kudos, are located in the EU, which means that the EU has a good foothold in what is looks to be a big and expanding digital marketplace. Thirdly, with scholars increasingly visible on the web and social media, even if the majority of their online activities are not directly related to their research, novel methods of analysing and providing immediate feedback about the performance of a journal, an

author or an article via indicators gathered in the real-time social web show potential for becoming a necessary complement to the traditional citation-based metrics for evaluating scholarly performance. Perhaps, then, Higher Education employers' arsenal of assessment tools to be used for hiring, tenure and promotion purposes might be enriched in the not so distant future.

The findings of this study support research conducted elsewhere (CIS/CIBER, 2013) in that there is very little doubt that the reputation for scholars in today's world is highly skewed towards academic research and the reputational systems largely reflect that reality. The most popular reputational platforms deal mostly with research and even then only traditional research activities, such as journal article publishing. They are becoming a little more innovative in regard to measurement, and altmetrics are increasingly used, if not fully trusted. There seems to be no empiric evidence directly supporting the prestige-conferring capabilities of academic managerial positions. They have considerable attractions, but enhanced prestige is not specifically numbered among them. Teaching and learning surely are the glaring holes in the reputational armoury being built in the digital space. So many people are involved in teaching, so much is done in its name and it generates so much income that it seems inexplicable that it does not count towards scholarly reputation and platforms offer so little in the way of mechanisms for measuring it. Often, as in the case of the UK, some of the data is there, but provided at an aggregated institutional and/or departmental level and then factored into university rankings produced by the media. Oddly, while research performance is readily ascribed to individuals and made public, this is mainly not the case for teaching. Here is a case where the scholarly system lacks openness and this should be addressed.

While the digital transition has unleashed powerful disruptional and enabling forces, such as Web 2.0, it has also given rise to a truly massive explosion of scholarly content and players. This raises fears about the quality and trustworthiness of scholarly communications and concerns about managing the explosion, and more often than not scholars (and managers and scientific policy makers) have taken refuge in traditional values and measurements in order to cope. This means that scholars trust citation measures and high impact journals and not the social media and altmetrics. That is until a means of evaluating the quality and provenance of such outputs and measures are put in place, and, indeed, the Horizon 2020 programme proposes to investigate the whole area.[11]

Research reputation is established at the international level (and so Europe has to abide by international rules), but many of the other scholarly activities tend to be established/judged at a local or national level. Research with an international market is clearly an area where progress can be made more readily because investments are more likely to bear fruit and changes are introduced more quickly.

There are fears in respect to the main directions of travel for the reputational market. Thus one school of thought believes that too much power should not be invested in any one platform (the preference is for multiple and competitive systems to fight it out) because of the sheer importance of reputation in the scholarly field. The other school believes the very opposite, that by having just a couple of platforms, rather than, say, the 25 we have at the moment, is the only way to: a) get widespread adoption; b) avoid the 'Balkanisation' of reputation, whereby scholars would pick the reputational system which shows them up best. Of course, they are already doing this with citation-based metrics.

[11] http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/2410-garri-4-2015.html

3.2 Should something be done about this state of affairs and what would be the benefits to society and scholarship?

This investigation of the emerging reputation mechanisms for scholars can be seen as part and parcel of the powerful, Europe-wide initiatives for reforms in the Higher Education system, as reflected, most recently, in the European Commission's modernisation agenda.[12] Proceeding from the notion that in the globalised, competitive, Science 2.0 driven, knowledge-based society of today the future hinges on research, innovation and education for all, these initiatives call for a redefinition and reconstruction of the academic enterprise and the roles of its principal stakeholders, the Higher Education institutions and the scholars they employ. In this context, focussing on the quest for reputation, indubitably a central pursuit of the scientific endeavour on both the individual and the institutional level, certainly is a move in the right direction.

Arguably, it is the aforementioned disproportionate weight given to traditional research achievements (publications and citations) above all other scholarly activities (inclusive of teaching) in assigning reputation, as reflected in the gap in the coverage of the reputational platforms, that seems to call for the most urgent reformative action. This, in view of the goals and ensuing policy initiatives that have been driving the European academic enterprise for quite some time now, which see research and teaching not only as mutually dependent and reciprocally reinforcing, but also as equally important. Indeed, as the European Parliament resolution of 20 April 2012 on modernising Europe's higher education systems stresses, both excellence in research, in the broad sense of the term, and excellence in teaching and scientific achievement are to be rewarded.[13]

With good reason, too, as Altbach et al. (2009) and Kwiek (2012) suggest: although research and innovation have been and continue to be extremely important contributions to the economic and social development of society, indeed, central enablers of its ability to compete successfully in the international arena, producing a skilled labour force is more than ever critically important for the well-being of a state. Add to this that constant transformations in the labour market and in the economy in general render life-long learning an inescapable dictate of life in the 21st century, and the need for innovative, technology-supported, formal and informal university-level teaching that can cater to the distinctive needs of increasingly differentiated student populations, becomes quite obvious.[14]

Apparently then, if traditionally academic prestige has been related exclusively to rather narrowly defined research achievements, now that scholarly practices are slowly becoming more open and expansive, on the one hand, and the teaching component of scholarly undertakings has become a global/regional/national priority, on the other hand, it should no longer be so.

3.3 The way forward?

Ideally, the way forward would be through the empowerment of individual scholars to take risks and be protected and rewarded by the system for their initiative. After all, as it emerges quite clearly from the analysis undertaken in this study, scholars' various professional activities all bar none have reputation-conferring potential. This would have been all the more prudent, given that a Higher Education institution's standing depends at least to some extent on the prestige of its employees and vice versa, faculty standing depends on the prestige of their employers (Morrison et al., 2011), so that an individual's interests are aligned with those of the university. However, universities have a very narrow view of reputation, tied up as they are with research and the publication of academic papers, so that it is unlikely that they will be the forerunners of change.

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12 http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52012IP0139&rid=7

13 ibid

14 http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52013DC0654&from=EN

Things could have been different if allocating resources to Higher Education institutions were to become contingent upon demonstrated achievements in a wide range of research activities as well as teaching activities. This, as Broadbent's (2010) examination of the Research Excellence Framework (REF, formerly RAE) in the UK amply proves, is because policies implementing various performance-based national evaluation exercises and local accountability schemes act as a powerful lever of control on individual as well as institutional action – whether that is the intention or not. Thus, institutes wishing to maximise their revenue from the REF, as well as gain the reputation that a good REF ranking provides, are anxious to employ researchers who will maximise the scores, so that there is now a market for academics that relates to their perceived REF worth. It follows then that individuals with 'a good REF submission' gain reputational as well as monetary benefits. All this serves to highlight the potentially important role of funding agencies in bringing about change. These agencies are the power in the land when it comes to research, as they have shown in forcing open access through, despite widespread concerns, objections and apathy of scholars, and they seem to be doing similar with research impact. Member States wishing to change the existing reputational paradigm might reflect on this.

On a more practical level, the unanimous view of the expert group after reflecting on the project's findings is that there is a need to tip things in the direction that Science 2.0 is travelling. The best way forward would be via small scale 'seeding' experiments and evaluations. In other words, pebbles could be dropped into the pond to test the waters. Helping develop a reputational template for teaching activities is clearly a priority here. The main reason why the expert group believed this would be best way forward is that the field is still young and emerging and that it should have freedom to develop before any interventions by the EC. However, the field is also impressible and malleable and therefore there are nudging opportunities where the EC should facilitate rather than prescribe. Stakeholders should be moving into a laboratory stage of research lasting several years. It was also thought that any programme of research needs to take more account diversity in the Member States, as, indeed, the study reported here did.

Are there any opportunities for fast-forwarding developments, without endangering things? The US has incubated two-thirds of the services, including the two most popular ones (LinkedIn and Academia.edu), so one possibility would be to look at what is happening in order to learn from good practices.

Also, it is probably best to let the disruptive technologies ring in the changes and monitor their progress, possibly joining with them to get data on European scholars and identify where the best practice comes from. In other words, get the tail to wag the dog. It might be possible to work with a European reputational system, such as ResearchGate or Kudos. Thus paving the way to adopting and recognising a wider range of activities in reputational assessments, especially those related to the digital reality, a greater awareness and recognition of scholarly achievements will be conveyed. This greater reputational awareness of non-research activities will lead to an expenditure of more effort on the part of scholars on these activities, bringing about an inevitable improvement in them. Pertinent examples would be raising public awareness of issues of health risk factors, encouraging public engagement and obtaining more transparency in science.

And finally, seemingly unrelated developments in the scholarly world may very well bring about reputational changes, too. MOOCs (massive open online courses) are, of course, a case in point, demonstrating as they do, perhaps most eloquently, the potential of wide-reaching scholarly teaching for reputation building. This, as Daniel (2012) contends, because placing their MOOCs in the public domain for a worldwide audience will oblige institutions to do more than pay lip service to importance of teaching and put it at the core their missions. If so, scholars conducting MOOCs stand to gain twice: their teaching achievements will be taken into consideration whilst the massive and unlimited visibility, which is a feature of some internationally known MOOCs, will surely continue to contribute significantly to their scholarly and public reputation. Another example, a recent innovation, is the digital badge. A seemingly playful alternative to traditional diplomas, as

Young (2012) puts it, the digital badge offers the ability to measure and assess real learning and skills acquisition in a virtual environment (Schrage, 2012). While it is meant to serve as a valid and verifiable means of accreditation, the fact that a click on the badge reveals to all interested parties anywhere in the world its 'history', renders it a recognition and esteem granting device for its originator. This is obviously a most welcome by-product of investing time and effort in relatively underappreciated scholarly activities, such as citizen science projects.

3.4. Suggestions for further research

This was a relatively short, exploratory study and inevitably there are many things worth following up on. The 'Seeding' or 'nudging' research projects the EC might consider are:

1. 'Trialling' some of the missing research activities and/or targeting the new actors with the assistance of European platforms (ResearchGate or Kudos) and universities or scholarly societies.
2. Focussing on the big weakness of reputational platforms in respect to teaching and learning and see what aspects of teaching scholars want covered, what data are available, examine problems over its release and generally determine the appetite for it.
3. Canvassing employers and funders, the key parties who have not had sufficient voice in this research project. These groups are, of course, extremely influential. Funding agencies are the power in the land when it comes to research.
4. Lead the way by creating and assessing a Europe-wide quality assessment framework for reputational platforms.
5. There is virtually no research or even information about the new actors entering the field and this requires individual investigation.

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ANNEX 1: TABULATION OF SCHOLARLY ACTIVITIES

Table I.8: The scholarship of research:[15] scholarly activities and reputation mechanisms

ACTIVITY	PROCEDURE	SCIENTIFIC PURPOSE	REPUTATIONAL PURPOSE	FIT FOR PURPOSE REPUTATIONAL MECHANISM
Identifying a researchable topic	Detecting a gap in human knowledge which can be translated into a potentially solvable problem	Finding and formulating research question(s) to be pursued in order to extend/ change/contest extant knowledge	Producing persuasive evidence of both the significance of the proposed problem and its solvability in order to look into collaboration and funding possibilities	Constructing and refining through iterative exposure to colleagues an informally presented proposal for peer scrutiny of its validity and worth
Planning a research project	Defining and scoping a scholarly investigation towards producing an original contribution to human knowledge	Establishing how the theoretical perspective and the insights offered by the confirmed knowledge will combine with the data to be collected to inform the research question(s)	Producing persuasive evidence of scholarly proficiency-based ability to conduct the investigation as proposed, in order to enlist collaborators and obtain funding	Constructing and refining through iterative exposure to colleagues/funding bodies a formally structured proposal suitable for peer evaluation of its quality, authority and reliability
Building upon previous knowledge	Accessing, selecting, perusing/ reading, interpreting, critically analysing, using and citing reports of previously established knowledge	Conceptualising and contextualising a scientific truth-claim so that it can serve its goal of extending the certified knowledge already in existence	Attaining scholarly expertise- and proficiency-based eligibility for peer recognition and esteem	Demonstrating scholarly competence via the judicious selection of high quality and trustworthy scientific content to build upon
Requesting/providing help in locating research literature	Requesting/providing help in locating research literature inaccessible via a library or on the open web	Anchoring a research undertaking in the conceptual basis of a scholarly field	Achieving enhanced disciplinary and trans-disciplinary visibility via social networking	Finding and sharing research literature peer-to-peer or through crowdsourcing

[15] This is the first of Boyer's four components of scholarship, the one he calls the scholarship of discovery. It refers to the creation of new knowledge for its own sake

ACTIVITY	PROCEDURE	SCIENTIFIC PURPOSE	REPUTATIONAL PURPOSE	FIT FOR PURPOSE REPUTATIONAL MECHANISM
Producing research output[16]	Gathering/ generating, managing, processing and analysing data towards producing an original scientific contribution	Discovering new knowledge and/or achieving enhanced understanding	Attaining scientific-achievements based eligibility for peer recognition and esteem and for the ensuing career-related rewards/research opportunities	Presenting the results of a scientific investigation in a formally structured form suitable for peer evaluation of its quality, authority and reliability
Producing research output collaboratively	Gathering/generating, managing, processing, analysing and sharing data in a collaborative team towards producing an original scientific contribution	Synergistically discovering new knowledge and/or achieving enhanced understanding	Attaining scientific-achievements and affiliation[17] based eligibility for peer recognition and esteem and for the ensuing career-related rewards/ research opportunities	Presenting the results of a collaborative scientific investigation in a formally structured form suitable for peer evaluation of its quality, authority and reliability
Producing research output collaboratively in large-scale projects	Gathering/generating, managing, processing, analysing and sharing data in a distributed, large-scale, capital-intensive collaborative team towards producing an original scientific contribution	Synergistically discovering new knowledge and/or achieving enhanced understanding	Attaining scientific-achievements and affiliation based eligibility for peer recognition and esteem and for the ensuing career-related rewards/ research opportunities	Presenting the results of a collaborative scientific investigation in a formally structured form suitable for peer evaluation of its quality, authority and reliability
Producing research output by committed amateur experts[18]	Gathering/ generating, managing, processing and analysing data towards producing an original scientific contribution	Discovering new knowledge and/or achieving enhanced understanding	Attaining scientific-achievements based eligibility for recognition and esteem in the scholarly community as well as achieving public visibility and societal impact	Presenting the results of a scientific investigation in a formally structured form suitable for the scholarly community's evaluation of its quality, authority and reliability

[16] While the focus on traditional research outputs (articles, monographs, books) will likely remain critical into the foreseeable future, there is increasing recognition of the importance of other research outputs, too, such as research datasets, scientific software, posters and presentations at conferences, electronic theses and dissertations, blogs

[17] In academe it is not only what you produce, important a criterion for recognition as the quality of your research output is, but also who you are and where you come from

[18] Committed amateur/non-credentialed experts, working on their own, as exemplified by amateur astronomers, archaeologists and taxonomists, who make critical contributions to science that may not otherwise transpire owing to a lack of resources, time, skills, or inclinations in the professional scientific community

ACTIVITY	PROCEDURE	SCIENTIFIC PURPOSE	REPUTATIONAL PURPOSE	FIT FOR PURPOSE REPUTATIONAL MECHANISM
Releasing data to the scholarly community	Releasing sets of raw or derived/reduced data to the wider scholarly community pre- or post-completion of a scientific project	Enabling multiple users to productively use data for discovering new knowledge faster as well as opening up future opportunities for collaboration	Achieving enhanced disciplinary and trans-disciplinary visibility and scholarly impact based peer recognition and esteem, as reflected in citation and/or usage based metrics	Sharing citable data sets informally – peer to peer, or publishing them via institutional websites, data centres or repositories
Releasing methodologies, research tools and protocols to the scholarly community	Releasing information on methodologies, research tools and protocols to the wider scholarly community pre- or post-completion of a scientific project	Moving science forward at a quicker pace via enabling multiple users to productively utilise tried and tested methods for discovering new knowledge; promoting scholarly rigour and scrutiny	Achieving enhanced disciplinary and trans-disciplinary visibility and peer recognition via social networking	Transparent working practices: making methodologies, research tools and protocols available on the internet
Releasing laboratory notebooks to the scholarly community	Releasing real time laboratory notebooks and all associated raw data to the wider scholarly community (Open-Notebook Science)	Moving science forward at a quicker pace via input from outsiders as well as promoting scholarly rigour and scrutiny	Achieving enhanced disciplinary and trans-disciplinary visibility and gaining peer recognition via networking	Transparent working practices: making the entire process of a scholarly investigation available on the internet
Keeping up with new developments	Following new developments in one's area of expertise by gathering, selecting, perusing and reading newly disseminated scholarly information	Building on all relevant scientific progress made for discovering new knowledge and/or achieving enhanced understanding	Avoiding the danger of inadvertently duplicating costly and time-consuming research already done, which, if taken as a sign of ignorance, exposes a scholar to peer ridicule	Demonstrating scholarly proficiency and competence via keeping abreast of potentially relevant, high quality and trustworthy scientific content to build upon
Getting help for solving topical problems	Requesting assistance from and offering suggestions to colleagues either peer-to-peer or via online social networking sites	Solving topical problems arising in the course of research work	Achieving online scholarly visibility; advancing social networking; enhancing digital identity	Exchanging information, 'tips', resources, methodologies and research tools in social media based scholarly communities

ACTIVITY	PROCEDURE	SCIENTIFIC PURPOSE	REPUTATIONAL PURPOSE	FIT FOR PURPOSE REPUTATIONAL MECHANISM
Disseminating research results formally via traditional scholarly channels	Disseminating research results formally via traditional scholarly communication channels	Reporting the results of a scientific investigation for scholarly peers to verify/ critique, use and build upon	Securing priority of an original contribution; achieving scholarly visibility and gaining peer recognition and esteem through quantitative and qualitative research productivity	Publishing copiously in highly regarded and peer reviewed scholarly outlets[19], to achieve scholarly impact as reflected in citation and/or usage based metrics
Disseminating research results formally via Open Access scholarly channels	Disseminating research results formally via Open Access (OA) scholarly communication channels	Reporting the results of a scientific investigation for scholarly peers to verify/ critique, use and build upon and for practitioners and the public to use	Securing priority of an original contribution; achieving unimpeded scholarly visibility and gaining peer recognition through quantitative and qualitative research productivity	Publishing copiously in highly regarded and peer reviewed Open Access scholarly outlets[20], to achieve scholarly impact as reflected in citation and/or usage based metrics
Disseminating research results formally via enhanced Open Access scholarly channels	Disseminating research results formally via Open Access scholarly communication channels that offer innovative features (i.e. open peer review, data sharing, social reading options[21], plain language summaries, impact tracking via metrics)	Reporting the results of a scientific investigation for scholarly peers to verify/critique, use and build upon and for practitioners and the public to use	Securing priority of an original contribution; achieving unimpeded scholarly visibility and gaining peer recognition through quantitative and qualitative research productivity; achieving public visibility and societal impact, which contribute to scholarly prestige, too	Publishing copiously in highly regarded and peer reviewed Open Access scholarly outlets with innovative features, to achieve scholarly impact as reflected in citation and/or usage based metrics

[19] Most notably high Impact Factor/elite journals

[20] Here too, most notably high Impact Factor/elite journals.

[21] Content enhanced with social highlighting, ratings, note-sharing, tags, and links to Facebook and Twitter.

ACTIVITY	PROCEDURE	SCIENTIFIC PURPOSE	REPUTATIONAL PURPOSE	FIT FOR PURPOSE REPUTATIONAL MECHANISM
Disseminating research results informally via active participation in conferences	Disseminating research results informally via active participation in conferences (both face to face and virtual)	Reporting the results of a scientific investigation to update peers and obtain their scrutiny and feedback	Establishing priority of an original contribution; achieving scholarly visibility; gaining peer recognition and esteem; advancing one's social networking	Making research results accessible for peer recognition and scrutiny, both explicit and implicit[22], by giving a keynote talk/paper/ poster; live blogging/ live tweeting from the conference
Disseminating research results informally via repositories/websites	Disseminating research results informally via disciplinary/institutional repositories and/or personal/institutional websites	Reporting the results of a scientific investigation to update peers and interact with them in order obtain their scrutiny and feedback	Establishing priority of an original contribution; achieving online scholarly visibility; reaching multiple and diverse audiences; gaining peer recognition and esteem; advancing social networking	Making research results openly accessible for peer acknowledgement and scrutiny, both explicit and implicit
Disseminating research results informally via social media	Disseminating research results informally via social media sites appropriated and repurposed to fit scholarly objectives (i.e. YouTube, Twitter)	Reporting the results of a scientific investigation to update peers and the public and interact with them in order to obtain their scrutiny and feedback	Achieving online scholarly and public visibility; reaching multiple and diverse audiences; gaining peer and public recognition; advancing social networking; enhancing digital identity	Promoting a scholarly project/publication via announcements or specially created video trailers that make scientific results openly accessible for public and peer recognition and scrutiny, both explicit and implicit
Disseminating research results, ideas and opinions informally via scholarly social networking sites	Disseminating research results, but also ideas and informed opinions informally, via social networking sites specifically targeting scholars (i.e. Academia.edu, ResearchGate)	Reporting the results of a scientific investigation to update peers and interact with them in order to obtain their scrutiny and feedback; influence scholarly thinking and attitudes	Achieving online scholarly visibility; reaching multiple and diverse audiences; gaining peer recognition; advancing social networking; enhancing one's digital identity	Making research results, ideas and opinions openly accessible for peer acknowledgement and scrutiny, both explicit and implicit

[22] Explicit: for example, comments and ratings. Implicit: for example: tagging, bookmarking, re-tweeting, page views, downloads.

ACTIVITY	PROCEDURE	SCIENTIFIC PURPOSE	REPUTATIONAL PURPOSE	FIT FOR PURPOSE REPUTATIONAL MECHANISM
Disseminating research results, ideas and opinions informally via blogs	Disseminating research results, but also ideas and informed opinions informally, via research blogs	Reporting the results of a scientific investigation to update scholarly peers and the public; interacting with them in order to obtain their scrutiny and feedback; influencing scholarly thinking and attitudes	Achieving online scholarly and public visibility; reaching multiple and diverse audiences; gaining peer and public recognition; advancing social networking; enhancing one's digital identity	Making research results, ideas and opinions openly accessible for peer and public recognition and scrutiny, both explicit and implicit
Peer reviewing	Peer reviewing of others' research results as an editor-appointed referee	Maintaining and improving research quality and rigour through effective review and scrutiny	Gaining peer recognition and esteem for expert help in maintaining and improving research quality and rigour (if and when known)	Appearing on the list of a journal's editor-appointed referees; noting on one's CV or homepage having served as an editor-appointed referee
Participating in open peer reviewing	Participating alongside fellow scholars and non-professional scientists in open peer reviewing of others' data, software, protocols and research results	Maintaining and improving research quality and rigour through more open review and scrutiny processes	Gaining peer recognition and esteem for expert help in maintaining and improving research quality and rigour; achieving online scholarly and public visibility; enhancing one's digital identity	Posting reviews of others' research products/results on online sites, where open debates are conducted among self-appointed referees, whose identity is known to all
Monitoring one's impact	Monitoring the scholarly achievements based impact of one's research work	Accruing tangible evidence of the scientific quality and trustworthiness of one's research work so as to enable scholarly peers to use and build upon it	Accruing tangible evidence of scientific excellence towards gaining peer and public recognition and esteem and the ensuing career-related rewards/ research opportunities	Promoting one's scholarly impact via making openly accessible the scores achieved in: citations-based bibliometric measures;[23] download/ visitor/link/ social network reference counts (altmetrics); net-native recognition metrics/ ratings[24]

[23] For example, the h index and its variants

[24] Online communities may have their own measures of value, such as the RG score of ResearchGate

Table I.9: The scholarship of integration[25]: scholarly activities[26] and reputation mechanisms

ACTIVITY	PROCEDURE	SCIENTIFIC PURPOSE	REPUTATIONAL PURPOSE	FIT FOR PURPOSE REPUTATIONAL MECHANISM
Identifying a topic for a comprehensive literature review/textbook	Detecting a need for a more wide-ranging understanding and/or novel perspectives based treatment of a complex/multi-faceted topic	Finding and formulating a research question to be pursued via the cross-fertilisation of knowledge, if need be across disciplines, in order to present a comprehensive, analytic portrayal of a topic	Producing persuasive evidence of the significance of the undertaking and its proposed integrative treatment in order to look into collaboration and publishing possibilities	Constructing and refining, through iterative, possibly social media based exposure to like-minded[27] colleagues an informally presented proposal for peer scrutiny of its validity and worth
Identifying a researchable multiple-faceted topic	Detecting a gap in human knowledge, typically arising from a complex, societal, often global challenge, which can be translated into a potentially solvable problem	Finding and formulating a research question to be pursued via the cross-fertilisation of knowledge, if need be across disciplines, in order to extend/change/ contest extant knowledge	Producing persuasive evidence of both the significance of the proposed problem and its integrative-approach solvability in order to look into collaboration and funding possibilities	Constructing and refining, through iterative, possibly social media based exposure to like-minded colleagues an informally presented proposal for peer scrutiny of its validity and worth
Planning a comprehensive literature review/textbook project	Defining and scoping a scholarly investigation towards producing an integrative, often multi- or inter-disciplinary interpretation of extant knowledge on a topic	Offering new, synthesised interpretations of extant knowledge on a complex topic via the cross-fertilisation of knowledge, if need be across disciplines	Producing persuasive evidence of a multi-faceted, scholarly proficiency-based capability to conduct the investigation as proposed, in order to enlist collaborators and publishers	Constructing and refining through iterative exposure to colleagues/publishers/editors a formally structured proposal suitable for peer evaluation of its quality, authority and reliability

[25] This is the second of Boyer's four components of scholarship, which refers to the arraying of extant knowledge into larger intellectual patterns within a wider, cross-disciplinary context

[26] As the scholarship of integration is just as much concerned with creating knowledge as the scholarship of research, many of the activities of the former are essentially identical in their nature to those characterising the latter. Therefore, only those activities that reflect the idiosyncratic features of this synthesis-aimed, often inter- and/or multi-disciplinary approach are delineated here

[27] The strong cultural norms characterising social media based communities may at times bring about a greater affinity among today's scholars than their disciplinary-affiliation based collegial relationships

ACTIVITY	PROCEDURE	SCIENTIFIC PURPOSE	REPUTATIONAL PURPOSE	FIT FOR PURPOSE REPUTATIONAL MECHANISM
Planning an integrative research project	Defining and scoping a scholarly investigation towards producing an integrative, often multi- or inter-disciplinary approach based original contribution to human knowledge	Establishing how a wide angle, possibly cross-disciplinary theoretical perspective and the insights offered by the confirmed knowledge will combine with the data to be collected to inform the research question	Producing persuasive evidence of a multi-faceted, scholarly proficiency-based capability to conduct the investigation as proposed, in order to enlist collaborators and obtain funding	Constructing and refining through iterative exposure to colleagues/funding bodies a formally structured proposal suitable for peer evaluation of its quality, authority and reliability
Producing a literature review/textbook via traditional strategies	Aggregating, perusing/ reading, interpreting, critically analysing, integrating and citing reports of previously established knowledge on a topic	Achieving an integrative, often multi- or inter-disciplinary interpretation and understanding of the established knowledge on a topic	Attaining scholarly expertise- and proficiency-based eligibility for peer recognition and esteem	Demonstrating scholarly competence via the judicious selection and synthesis of high quality and trustworthy scientific content from traditional sources
Producing a literature review/textbook via open strategies	Using a social networking space to aggregate and collectively discuss an evolving body of literature on a topic	Achieving an integrative, often multi- or inter-disciplinary interpretation and understanding of the extant knowledge and informed opinion on a topic	Attaining scholarly expertise- and proficiency-based eligibility for peer recognition and esteem; advancing social networking; enhancing one's digital identity	Demonstrating scholarly competence via the judicious selection and synthesis of high quality and trustworthy content from multiple formal and informal sources
Producing an integrative research output[28]	Gathering/generating, managing, processing and analysing data towards producing an integrative, often multi- or inter-disciplinary approach based original contribution	Discovering novel perspectives afforded new knowledge and/or achieving enhanced insights and more comprehensive understandings	Attaining scientific-achievements based eligibility for peer recognition and esteem and for the ensuing career-related rewards/research opportunities	Presenting the results of an integrated- approach- based scientific investigation in a formally structured form suitable for peer evaluation of its quality, authority and reliability

[28] While the focus on traditional research outputs (articles, monographs, books) will likely remain critical into the foreseeable future, there is increasing recognition of the importance of other research outputs, too, such as research datasets, scientific software, posters and presentations at conferences, blogs.

ACTIVITY	PROCEDURE	SCIENTIFIC PURPOSE	REPUTATIONAL PURPOSE	FIT FOR PURPOSE REPUTATIONAL MECHANISM
Producing an integrative, often multi- or inter-disciplinary research output collaboratively	Gathering/generating, managing, processing, analysing and sharing data in a collaborative team, towards producing an integrative, often multi- or inter-disciplinary approach based original contribution	Synergistically discovering novel perspectives afforded new knowledge and/or achieving enhanced insights and more comprehensive understandings	Attaining scientific-achievements and affiliation[29] based eligibility for peer recognition and esteem and for the ensuing career-related rewards/ research opportunities; creating a network of relationships, often across disciplines	Presenting the results of a collaborative, integrated, often multi- or inter-disciplinary scientific investigation in a formally structured form suitable for peer evaluation of its quality, authority and reliability
Producing an integrative, often multi- or inter-disciplinary research output collaboratively in large-scale, distributed projects	Gathering/generating, managing, processing, analysing and sharing data in large-scale, distributed, capital-intensive collaborative teams, towards producing an integrative, often multi- or inter-disciplinary approach based original contribution	Synergistically discovering novel perspectives afforded new knowledge and/or achieving enhanced insights and more comprehensive understandings	Attaining scientific-achievements and affiliation based eligibility for peer recognition and esteem and for the ensuing career-related rewards/research opportunities; creating a network of relationships, often across disciplines	Presenting the results of a collaborative, integrated, often multi- or inter-disciplinary scientific investigation in a formally structured form suitable for peer evaluation of its quality, authority and reliability
Producing Open Education Resources (OER)[30]	Creating via integrative approaches, managing, improving and sharing open learning content through the utilisation of open source software tools	Expanding access to traditional and non-traditional learners and improving the quality of education through the development and open sharing of teaching resources	Creating a network of relationships, often across disciplines, through the global exchange of educational knowledge and resources; achieving public visibility and societal impact	Sharing freely on the web one's educational resources for everyone to use and reuse

[29] In academe it is not only what you write, important a criterion for recognition as the quality of your research output is, but also who you are and where you come from.

[30] Educational resources (full courses, lesson plans, instructional modules, syllabi, course materials, textbooks, streaming videos, tests, quizzes, games, simulations, software) offered freely and openly for educators, students and self-learners to use and reuse for teaching, learning and research.

Table I.10: The scholarship of application[31]: scholarly activities[32] and reputation mechanisms

ACTIVITY	PROCEDURE	SCIENTIFIC PURPOSE	REPUTATIONAL PURPOSE	FIT FOR PURPOSE REPUTATIONAL MECHANISM
Identifying a researchable topic focussing on practical problems experienced by public/practitioner audiences	Detecting a gap in human knowledge arising from a practical, societal/communal challenge, which can be translated into a potentially solvable problem	Finding and formulating a research question via partnering with practitioners and/or policy makers and/or community leaders in order to extend/ change/contest extant knowledge and its potential applications	Producing persuasive evidence of both the significance of the proposed problem and its solvability in order to look into collaboration and funding possibilities	Constructing and refining, through iterative, possibly social media based exposure to colleagues and community stakeholders an informally presented proposal for peer and public scrutiny of its validity and worth
Identifying a researchable topic focussing on practical problems experienced in organisational/industrial settings	Detecting a gap in human knowledge arising from a practical, organisational/ industrial challenge, which can be translated into a potentially solvable problem	Finding and formulating a research question via partnering with industrial/organisational practitioners in order to extend/change/ contest extant knowledge and its potential applications	Producing persuasive evidence of both the significance of the proposed problem and its solvability in order to look into collaboration and funding possibilities	Constructing and refining, through iterative, possibly social media based exposure to colleagues and industry-based stakeholders an informally presented proposal for peer and public scrutiny of its validity and worth

[31] This is the third of Boyer's four components of scholarship, which refers to the application of disciplinary knowledge and skill to societal/practical problems. This can take three main forms: in the first, the public, considered to have a low level of understanding, is the passive recipient of a unidirectional flow of information from the scholarly community (the deficit model); in the second, citizens, although not considered to be on equal footing with scholars, do work actively with science knowledge, as well as drawing on knowledge which is specific to local context (the 'dialogue', 'interactive', 'two-way' or 'consultation' model); in the third, citizens have a direct and active role in shaping research agendas, with both parties seeking to understand one another through deliberative collaborative procedures (t'participation' model).

[32] As the scholarship of application is just as much concerned with creating knowledge as the scholarship of research, many of the activities of the former are essentially identical in their nature to those characterising the latter. Therefore, only those activities that reflect the idiosyncratic features of this public-good-aimed, community-responsive or community-based approach are delineated here.

ACTIVITY	PROCEDURE	SCIENTIFIC PURPOSE	REPUTATIONAL PURPOSE	FIT FOR PURPOSE REPUTATIONAL MECHANISM
Planning a research project focussing on practical problems experienced by public or practitioner audiences	Defining and scoping a real-world-problem oriented scholarly investigation towards producing an application-aimed original contribution to human knowledge	Establishing how a theoretical perspective driven approach and the insights offered by the confirmed knowledge will combine with the data to be collected to inform the research question	Producing persuasive evidence of scholarly proficiency-based capability to conduct the investigation as proposed, in order to enlist collaborators and obtain funding	Constructing and refining through iterative exposure to colleagues/funding bodies a formally structured proposal suitable for peer and public evaluation of its quality, authority and reliability
Producing an application oriented research output[33]	Gathering/ generating, managing, processing and analysing data towards producing an application-oriented original scientific contribution	Discovering new knowledge that offers solutions to real-world problems and leads to application and action; arriving at unexpected insights and innovations	Attaining scientific-achievements based eligibility for peer recognition and career-related rewards/ research opportunities; achieving public visibility and societal impact, which, in their turn, can enhance scholarly prestige, too	Presenting the results of a scientific investigation both in the form of a societal publication[34] and in a formally structured form suitable for peer and public evaluation of its quality, authority and reliability
Producing a community-interest driven, application oriented research output	Gathering/generating, managing, processing, analysing and sharing data in a community-initiated and contracted project towards producing an application-oriented original scientific contribution	Discovering new knowledge on a community-interest (rather than field-developments) driven topic that leads to application and action; arriving at unexpected insights and innovations	Attaining scientific-achievements eligibility for peer recognition and career-related rewards/research opportunities; achieving public visibility and societal impact, which can enhance scholarly prestige, too	Presenting the results of a scientific investigation in the form of a report, a societal publication and in a formally structured form suitable for peer and public evaluation of its quality, authority and reliability

[33] While the focus on traditional research outputs (articles, monographs, books) will likely remain critical into the foreseeable future, there is increasing recognition of the importance of other research outputs, too, such as research datasets, scientific software, posters and presentations at conferences, electronic theses and dissertations, blogs

[34] Publication types such as newspaper articles, television appearances, presentations for non-academic audiences, exhibitions, websites and social media

ACTIVITY	PROCEDURE	SCIENTIFIC PURPOSE	REPUTATIONAL PURPOSE	FIT FOR PURPOSE REPUTATIONAL MECHANISM
Producing an application oriented research output through a PPSR (public participation in scientific research)[35] project	Taking part together with amateur experts in gathering, managing, processing, analysing and sharing data towards producing an application-oriented original scientific contribution	Discovering new knowledge that offers solutions to real-world problems and leads to application and action; arriving at unexpected insights and innovations	Attaining scientific-achievements based eligibility for peer recognition and esteem; achieving public visibility and societal impact, which can enhance scholarly prestige, too	Presenting the results of a scientific investigation both in the form of a societal publication and as a formally structured paper
Participating in the commercialisation of one's inventions/discoveries (for example, by filing patents)	Translating research-generated knowledge into commercial applications for economic benefit	Releasing to the public full details of a potentially useful invention/discovery, often registered as a patent	Securing priority of an original contribution; achieving public and scholarly visibility and gaining peer and societal recognition and esteem	Presenting the results of a scientific investigation both in the form of a societal publication and as a formally structured paper
Serving industry or government as an external consultant	Using one's expertise and/or knowledge to address specific community or organisational needs (long term or ad hoc)	Providing scholarly expertise and/or knowledge which offer solutions to real-world problems and lead to application and action	Achieving public and scholarly visibility and gaining peer and societal recognition and esteem	Demonstrating scholarly expertise and competence via reporting in public media and/or social media based channels on one's outreach services and achievements
Serving one's professional/disciplinary community	Using scholarly expertise and/or knowledge to benefit one's professional/ disciplinary community (i.e. sitting on committees, serving as a journal editor, assuming leadership roles in professional organisations)	Providing scholarly expertise and/or knowledge towards maintaining and furthering the aims and undertakings of one's professional/ disciplinary community	Achieving scholarly visibility and gaining peer recognition and esteem for fulfilling leadership roles in one's professional/disciplinary community; advancing social networking	Noting on one's CV or homepage the leadership roles fulfilled in one's professional/disciplinary community; taking an active part in professional community held social functions (i.e. reporting on editorial achievements)

[35] Projects in which public participants take part to varying degrees in the scientific research process (for a detailed examination of the three models of public participation in scientific research see the table summarising the activities pertaining to the scholarship of co-creation)

ACTIVITY	PROCEDURE	SCIENTIFIC PURPOSE	REPUTATIONAL PURPOSE	FIT FOR PURPOSE REPUTATIONAL MECHANISM
Popularising scientific knowledge	Familiarising the public with the extant knowledge on a scientific topic via the plain language exposition of a scientific topic (i.e. a general interest book or a television programme)	Promoting public understanding of scientific ideas and their often value-judgments-associated implications (such as in the case of genetic modification)	Attaining scholarly expertise- and proficiency-based eligibility for public recognition and esteem; creating a network of communal relationships; achieving public visibility and societal impact	Demonstrating scholarly competence via the expert selection, synthesis and presentation of high quality and trustworthy content from multiple formal and informal scholarly sources

Table I.11: The scholarship of teaching[36]: scholarly activities and reputation mechanisms

ACTIVITY	PROCEDURE	SCIENTIFIC PURPOSE	REPUTATION AL PURPOSE	FIT FOR PURPOSE REPUTATIONAL MECHANISM
Designing a course/learning programme[37]	Laying out a route map of the purposeful configuration of suitable content, activities, tools, and methods of delivery and assessment towards the construction of a classroom and/or web based course/learning programme	Establishing how extant knowledge may best be transmitted/shared to promote and support an effective learning process	Producing persuasive evidence of disciplinary, pedagogical and technological proficiency-based ability to teach the course/programme as proposed, in order to attain peer and public recognition and enlist participants	Constructing and refining, possibly through iterative exposure to colleagues, a formally or informally disseminated proposal suitable for peer and/or student/ and/or public evaluation of its quality and potential effectiveness
Producing and delivering a teacher focussed[38], face-to-face, institution-based, often access controlled course/ learning programme	Conducting a course/ programme, organised as a tightly knit group with designated roles and hierarchies, towards transferring information from the syllabus to learners, most notably by means of lectures	Achieving effective learning via the transmission of disciplinary knowledge from the expert knower to his/her audience	Attaining disciplinary expertise and pedagogical achievements based eligibility for peer and student recognition and esteem and for the potentially ensuing career-related rewards/ opportunities	Access and/or participation based institutional (students' and authorised colleagues') monitoring and evaluation of the learning experience, its quality, effectiveness and impact, both explicit and implicit[39]

[36] This is the fourth of Boyer's four components of scholarship, which refers to the conveying of the human store of knowledge to new generations. However, the scholarship of teaching extends beyond scholarly teaching to include the building upon the latest ideas in a given disciplinary field as well as current ideas about teaching in the field, the creating of practices of classroom assessment and evidence gathering, peer collaboration and peer review.

[37] The terms 'course' or 'learning programme' refer to theory-driven, systematised units of learning, designed for a planned educational purpose, which can be for credit/not for credit, fee-based or free, face to face/on-line/blended.

[38] The teacher focussed/information transmission approach to teaching is based on an idea of the teacher as the focal point of teaching, as opposed to the student focussed/conceptual change approach, which endeavours to change the students' conceptions of the phenomena of their study.

[39] Explicit: for example, comments and ratings. Implicit: for example: tagging, bookmarking, re-tweeting, page views, downloads.

ACTIVITY	PROCEDURE	SCIENTIFIC PURPOSE	REPUTATION AL PURPOSE	FIT FOR PURPOSE REPUTATIONAL MECHANISM
Co-producing and co-teaching a teacher focussed, face-to-face, institution-based, often access controlled course/learning programme	Collaboratively conducting a course/programme, organised as a tightly knit group with designated roles and hierarchies, towards the transmission of knowledge to learners, most notably by means of lectures	Achieving effective learning via the synergistic transmission of disciplinary knowledge from expert knowers to their audience	Attaining expertise as well as pedagogical achievements based eligibility for peer and student recognition and esteem and for the potentially ensuing career-related rewards/ opportunities	Access and/or participation based institutional (students' and authorised colleagues') monitoring and evaluation of the learning experience, its quality, effectiveness and impact, both explicit and implicit
Producing and delivering a teacher focussed, online, institution-based, either access controlled or freely accessible course/ learning programme	Conducting a course/ programme, organised as a tightly knit networked group with designated roles and hierarchies, towards the transmission of knowledge to learners through web-based tools (social networking sites, blogs)	Achieving effective learning via the technology-aided transmission of disciplinary knowledge from the expert knower to his/her audience	Attaining expertise as well as pedagogical and technological achievements based eligibility for peer and student recognition and esteem and for the potentially ensuing career-related rewards/ opportunities	Access and/or participation based institutional (students' and authorised colleagues') monitoring and evaluation of the quality, effectiveness and explicit and implicit impact of the learning experience
Co-producing and co-teaching a teacher focussed, online, institution-based, either access controlled or freely accessible course/ learning programme	Collaboratively[40] conducting a course/programme, organised as a tightly knit networked group with designated roles and hierarchies, towards the transmission of knowledge to learners through web-based tools (i.e. social networking sites, blogs)	Achieving effective learning via the synergistic, technology-aided transmission of disciplinary knowledge from expert knowers to their audience	Attaining expertise as well as pedagogical and technological achievements based eligibility for peer and student recognition and esteem and for the potentially ensuing career-related rewards/ opportunities	Access and/or participation based institutional (students' and authorised colleagues') monitoring and evaluation of the quality, effectiveness and explicit and implicit impact of the learning experience

[40] 'Collaboratively' in the case of online courses can mean 'with the help of so called online network monitors' – colleagues who agree to collectively aid in the teaching process

ACTIVITY	PROCEDURE	SCIENTIFIC PURPOSE	REPUTATION AL PURPOSE	FIT FOR PURPOSE REPUTATIONAL MECHANISM
Conducting a social networks based, participatory MOOC (massive open online course)	Facilitating the learning process in a free, university level, web-based, course/ learning programme that harnesses crowd sourcing and networking technologies to enable the participatory-processes-based achieving of shared learning goals	Achieving effective learning via participants' reciprocal engagement in a continual flow of expert-facilitated dialogue and exchange of knowledge	Achieving massive online scholarly and public visibility; reaching multiple and diverse audiences; gaining peer and public recognition; advancing social networking; enhancing digital identity	Participation based public and peer monitoring and evaluation of the quality, effectiveness and explicit and implicit impact of the learning experience
Pursuing the Open-Notebook Science model in the classroom	Drawing upon students for collaboration in an ongoing scientific investigation, whilst enabling them to follow closely the actual processes involved via Open-Notebook Science methods	Modeling of best practices in a scientific inquiry for the benefit of learners/novice researchers	Achieving enhanced visibility and gaining peer and public recognition via networking	Transparent working practices: making the entire process of a scholarly investigation/teaching project available on the internet
Tutoring/mentoring students on an individual basis	Advising and guiding students on discipline-specific, increasingly web-based inquiry processes	Conveying and modeling of best practices in a scientific inquiry for the benefit of learners/novice researchers	Attaining expertise, as well as pedagogical and technological achievements based eligibility for student recognition and esteem and for the potentially ensuing career-related rewards/ opportunities	Students' monitoring and evaluation of the learning experience, its quality, effectiveness and impact as expressed in institutional/ state-wide teacher ratings

ACTIVITY	PROCEDURE	SCIENTIFIC PURPOSE	REPUTATION AL PURPOSE	FIT FOR PURPOSE REPUTATIONAL MECHANISM
Advancing learning theory through classroom research	Gathering and analysing feedback on teaching practices, either via explicit, learner feedback data (i.e. ratings) or implicit, learning analytics[41]/ social analytics[42] generated data	Discovering new pedagogical knowledge and/or achieving enhanced understandings of instructional design	Attaining pedagogical-achievements based eligibility for peer recognition and esteem and for the ensuing career-related rewards/research opportunities	Presenting the results of a classroom research based contribution to pedagogy in a formally structured form suitable for peer evaluation of its quality, authority and reliability

[41] Learning analytics are the measurement, collection, analysis, and reporting of data about learners

[42] Social analytics are automated methods for examining, filtering and categorising social media content, which can yield data on learners' ideas, questions, interests, etc.

Table I.12: The scholarship of co-creation[43]: scholarly activities and reputation mechanisms

ACTIVITY	PROCEDURE	SCIENTIFIC PURPOSE	REPUTATIONAL PURPOSE	FIT FOR PURPOSE REPUTATIONAL MECHANISM
Participating as a consultant in a PPSR (public participation in scientific research)[44] project	Participating as a consultant in a citizen-conceived, possibly also citizen-planned and executed science project, which typically aims at resolving local concerns via formal knowledge production	Providing professional scholarly help in amateur-experts focussed discovery of new knowledge, typically aimed at resolving local concerns	Achieving public visibility and societal impact, which, in their turn, can enhance scholarly prestige, too	Presenting the results of a scientific investigation in the form of a societal publication
Leading a Contributory PPSR (public participation in scientific research)[45] project	Planning and managing a project based on citizen-collected data, which aims at formal knowledge production but has a strongly valued, if often unstated educational purpose, too	Spatially and temporally expanding the scope of discovering new knowledge; promoting learning and reflecting about science concepts, theories and processes; promoting competent and responsible civic participation	Attaining eligibility for peer recognition and esteem; achieving public visibility and societal impact, which, in their turn, can enhance scholarly prestige, too	Presenting the results of a scientific investigation both in the form of a societal publication[46] and as a formally structured paper
Leading a Collaborative PPSR (public participation in scientific research)[47] project	Planning and managing a project based on amateur experts' help in the research process, which typically aims at resolving local concerns via formal knowledge production but has a strongly valued, if often unstated educational purpose, too	Spatially and temporally expanding the scope of discovering new knowledge; arriving at unexpected insights and innovations; promoting learning and reflecting about science concepts, theories and processes; promoting competent and responsible civic participation	Attaining eligibility for peer recognition and esteem; achieving public visibility and societal impact, which, in their turn, can enhance scholarly prestige, too	Presenting the results of a scientific investigation both in the form of a societal publication and as a formally structured paper

[43] This is a fifth component of scholarship (Garnett and Ecclesfield, 2011), updating Boyer's four, which refers to the increasingly converging processes of knowledge discovery and knowledge transmission and the resultant blurring of the distinction between the roles of researcher and teacher

[44] PPSR projects, in which public participants take part to varying degrees in the scientific research process, follow three models, as identified in Shirk et al (2012): contributory, collaborative and co-created.

[45] A Contributory PPSR project, also referred to as a citizen science research project, is typically designed and led by scientists, with members of the public primarily contributing data

[46] Publication types such as newspaper articles, television appearances, presentations for non-academic audiences, exhibitions, websites and social media

[47] A Collaborative PPSR project, also referred to as a community involvement/adaptive citizen science/adaptive co-management research project, is typically designed and led by scientists, with members of the public contributing data but also helping to refine project design, analyse data and disseminate findings

ACTIVITY	PROCEDURE	SCIENTIFIC PURPOSE	REPUTATIONAL PURPOSE	FIT FOR PURPOSE REPUTATIONAL MECHANISM
Collaborating in a Co-Created PPSR (public participation in scientific research)[48] project	Collaborating with amateur experts in the democratised research processes of a Co-Created PPSR project, which typically aims at resolving local concerns via formal knowledge production but has a strongly valued, if often unstated educational purpose, too	Spatially and temporally expanding the scope of discovering new knowledge; arriving at unexpected insights and innovations; promoting learning and reflecting about science concepts, theories and processes; promoting competent and responsible civic participation	Attaining scientific-achievements based eligibility for peer recognition and esteem as well as achieving public visibility and societal impact, which, in their turn, can enhance scholarly prestige, too	Presenting the results of a scientific investigation both in the form of a societal publication and as a formally structured paper
Conducting a PPSR (public participation in scientific research) project in the classroom or in a web based course/learning programme	Facilitating the learning process in a PPSR project, which involves students in the research process as well as in the civic participation and action the scientific inquiry entails	Achieving effective learning; promoting learning and reflecting about science concepts, theories and processes; promoting competent and responsible civic participation	Attaining disciplinary expertise and pedagogical achievements based eligibility for peer and student recognition and esteem and for the potentially ensuing career-related rewards/ opportunities	Access and/or participation based institutional (students' and authorised colleagues') monitoring and evaluation of the learning experience, its quality, effectiveness and impact, both explicit and implicit[49]

[48] A Co-Created PPSR project, also referred to as a participatory/participatory action research project, is typically designed by scientists and members of the public working together, with the public participants actively involved in most or all aspects of the research process

[49] Explicit: for example, comments and ratings. Implicit: for example: tagging, bookmarking, re-tweeting, page views, downloads

ANNEX 2. LIST OF REPUTATIONAL PLATFORMS

Platform	Type	Launched	No of activities covered	Type of activities covered
Academia	Multidisciplinary academic social networking service	2008	11	Research, Application
Academici	Multidisciplinary academic social networking service	2008	5	Research, Application
BibSonomy	Reference management tool	2006	3	Research
Biomedexperts	Discipline specific academic social networking service	2009	4	Research, Application
CourseTalk	Review system for MOOCs	2012	3	Teaching
Dryad	Data repository	2008	1	Research
Edmodo	Social learning platform	2008	0	-
Epernicus	Discipline specific academic social networking service	2007	4	Research, Application
Foldit	Citizen science platform	2008	5	Co-creation
GitHub	Code repository	2008	1	Research
Kudos	Altmetric service	2014	2	Research
Impactstory	Altmetric service	2011	1	Research
Labfolder	Electronic laboratory notebook	2013	0	-
LabRoots	Multidisciplinary academic social networking service	2008	9	Research, Application, Integration
LinkedIn	Professional social networking service	2002	2	Application
Mendeley	Reference management tool	2009	2	Research
myExperiment	Discipline specific academic social networking service	2007	4	Research
MyNetResearch	Multidisciplinary academic social networking service	NA	3	Research
MyScienceWork	Multidisciplinary academic social networking service	2010	1	Research
Peer Evaluation	Open peer review system	2010	1	Research
Profology	Multidisciplinary academic social networking service	NA	2	Research
ResearchGate	Multidisciplinary academic social networking service	2008	17	Research, Application, Integration
Scitable	Discipline specific academic social networking service	2009	2	Research
Socientize	Citizen science platform	2012	5	Co-creation
Stack Overflow	Q & A site	2008	1	Research

Part II

Analysis of Alternative Funding Mechanisms for Scientific Research

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EXECUTIVE SUMMARY

Research funding itself has substantially evolved in the last century towards a more competitive and accountable system, in order to meet the challenges of increased international competition and respond to the results of internal evaluation exercises. More recently, we have seen the emergence of a novel research funding scheme by unconventional actors: crowdfunding, private philanthropy, inducement prizes, and other bottom-up funding instruments. Policy-makers have started to consider their implementation, and the EC in particular has implemented several open funding mechanisms (FET, inducement prizes) and mentioned the importance of philanthropy and crowdfunding for the objectives of EU Innovation policy and Horizon 2020 in particular.

Yet, it is not clear what these mechanisms have in common, how spread they are and what the implications of using such mechanisms are.

Accordingly, the main purpose of this study is to formulate a conceptual framework to define what alternative funding is and to capture all its different features; to identify as much as possible the availability and functionality of such mechanisms in Europe; as well as the emerging positive and negative implications for researchers and research institutions. The methods used are literature review; desk research to map the mechanisms; and in depth case studies of such mechanisms.

The notion of "alternative" refers to two dimensions, the WHO and the HOW: the source of the funding (private rather than governmental) and/or to the modality how funds are distributed. This alternative modality concerns in particular how the lack of a rigid top-down setting of research priorities; and the openness of the decision-making process to select the beneficiary.

Therefore, based on our desk research, define alternative funding mechanisms for research as competitive research-funding mechanisms that fulfil any of these cases:

- Are led by non-governmental organizations; OR
- Set research priorities in an open way without strong identification of research priorities; OR
- Select proposals through other means than peer review of the projects.

Our analysis shows that alternative funding mechanisms are already well present throughout the EU. Based on web searches, we were able to identify 45 mechanisms in Europe spread in 14 countries, fairly divided between crowdfunding, philanthropy and open bottom-up government funding.

While different disciplines are covered and most mechanisms do not indicate a specific thematic focus, philanthropic mechanisms show a strong focus on health-related disciplines.
The four case studies analysed where:

1. I Lowe you, a research project on a rare disease which obtained 45.000 EUR through a crowdfunding platform in Spain
2. Fondazione Fondo Ricerca e Talenti, a university-based crowdfunding platform that funds research-related projects by students and raised 10.000 EUR for 3 projects on humanities in Italy
3. Puli Team, a finalist project of the Google Lunar X Prize challenge competing for the 20M EUR prize, based in Hungary
4. IDEAS Factory, a collaborative open sandpit process to generate and select multidisciplinary research projects, launched by the UK Research Council EPSRC.

Based on the literature review and case studies, we identified the following implications for the researchers and the research institutions:

The diversity of funding could increase the diversity and creativity of science: alternative funding mechanisms are effective in attracting new players that are typically not reached through public funding, and niche themes that are overlooked by traditional funding. Multidisciplinarity is fostered by more open, demand led collaborative mechanisms such as sandpit and inducement prizes.

At the same time there are risks: some unethical research issues could be addressed and there could be an excessive focus applied research and socially relevant issues, such as health; hence the risk for less, rather than more, diversity. The increasing focus on results-based funding puts the risk of research increasingly in the hands of researchers themselves (as in the case of inducement prizes): a new and more balanced social contract has to be negotiated to make sure research does not become a job for affluent people only.

Research organisations will have to increasingly deal with a plurality of funders and be able to engage with different mechanisms. This does not necessarily mean that organisations should build their own mechanisms and platforms, but there should be an organisational culture (and skills) that enables dealing with different existing mechanisms.

Communication is set to become a basic skill for researchers: all these mechanisms require greater attention to communication and communication is mentioned across all cases as much more time-intensive than expected. This effort in communication is not finalized only to raise money, but generates important positive spillovers as it generates greater systemic interactions with other actors in the ecosystem, and in particular between researchers and society. Funding is not just a transaction; it is the establishment of a relation. When dealing with specific health problems, for instance, fundraising will also become a community-building activity that is likely to generate rich exchanges of information between researchers and patients that will advance the research itself, as in the case of "I Lowe You". At the societal level, fundraising also becomes an awareness raising activity about scientific research, as in the case of "Team Puli". Lastly, discussing funding becomes also an opportunity to create networks of collaboration among scientists with similar research interests, as well as other stakeholders, as in the case of the "Sandpit" initiative. Research organisations should recognize this need for communication, provide scientist with adequate skills and possibly with support services to maximize the communication impact of the research projects

We were also able to draw a limited set of policy-relevant conclusions.

Alternative funding mechanisms are here to stay: there are already a wide variety of such instruments across EU countries. Moreover, alternative funding matters because it is deeply connected to long term trends internal to science. In particular, the emergence of "Mode 2" science identified the same trends that underpin alternative funding: the emergence of a plurality of funders, beyond government, that fund ad-hoc groups of scientists and not scientists around problems that are socially relevant. Alternative funding mechanisms are part of a long term historical trend towards more "liquid" forms of organisations that is visible in the development of science – and probably of society in general.

Alternative funding mechanisms are effective in addressing some of the existing critical aspects of public funding, such as the excessive top-down design of public funding, the need for greater links with "societal issues" and the strong "usual suspects" effect in selecting the beneficiaries.

However, these mechanisms are not a substitute for government funding and actually require a greater role for government in steering this new emerging "research funding ecosystem" towards socially beneficial goals. The funding provided by this mechanism should be considered as additional and complementary to public funding. Indeed, the leveraging and combination of different mechanisms is one of the key lessons that government should learn from these mechanisms.

In conclusion, we are able to formulate some very general and early stage recommendations for policy-makers based on the available evidence:

- Analyse and learn lessons from these mechanisms, such as the introduction of more open funding mechanisms (e.g. inducement prizes)
- Design for synergy between the different existing mechanism, in particular with regard to the possibility for additional funding to projects that manage to achieve funding from alternative sources
- Put in place governance mechanisms to ensure maximum societal benefit of this funding ecosystem, in order to address the funding gaps, ensure a minimum set of common criteria (such as on ethical issues) and to avoid redundancy and dispersion of resources.

Most of all, these findings show the urgent need for a more large-scale systematic analysis of the availability and impact of such mechanisms in Europe.

1 INTRODUCTION

This is the final report of the study on "Analysis of alternative funding mechanisms for scientific research", carried out by Open Evidence for JRC IPTS from July 2014 to January 2015.

Research funding itself has substantially evolved in the last century in order to meet the challenges of increased international competition and respond to the results of its evaluation exercises. Recently, we have seen the emergence of a novel research funding scheme by unconventional actors: crowdfunding, private philanthropy, inducement prizes, and other bottom-up funding instruments. Yet, it is not clear what these mechanisms have in common, how spread they are and what the implications of using such mechanisms are.

Accordingly, the main purpose of this study is to formulate a conceptual framework to define what alternative funding is and to capture all its different features; to identify as much as possible the availability and functionality of such mechanisms in Europe; as well as the emerging positive and negative implications for researchers and research institutions.

In this section, we introduce the background of the study, its objectives and methods. In the next chapter, we present the main findings of the literature review and case studies. In the third chapter, we extrapolate some implications emerging from the findings and derive policy-relevant conclusions.

1.1 The problem: designing funding mechanisms fit for mode 2 science and science 2.0

Research and innovation policy is accelerating towards an "innovation policy mix" (OECD, 2010), in a culture of experimentation of novel approaches to innovation in policy-making. Experimental approaches are now emerging and organisations such as NESTA have launched initiatives to experiment and assess innovation policies through Randomized Control Trial initiatives.[50]

1.1.1 The evolution towards competitive funding methods

However this is not an entirely new approach: taking a historical perspective, the funding of science has constantly evolved and it has undergone significant changes in the last 50 years, mainly moving from a block-based funding to a competitive, project-based funding. After World Ward II, public funding was mainly block-based, under the assumption that the scientific community knew best what should be researched, and how. This was based on a fundamental trust in science as a factor of progress, and regulated by a social contract also known as "the republic of science" (Polanyi, 1962).

In the 1970s, this agreement came under growing criticisms. The rise of "New Public Management" models (Lave, Mirowski, & Randalls, 2010), the distrust of politicians towards scientific productivity, the call for greater accountability of public spending, the increased importance of science as a factor of competitiveness contributed to a shift towards performance-based regimes, largely based on competitive models (Guston, 2000). Competitive, project-based funding started to become commonplace as a way to distribute public funding. This implied a greater capacity of governments to influence the behaviour of research institutions and researchers: government agencies were enabled to make research organisation more responsive to broader socio-economic objectives, i.e. in terms of national competitiveness. They were also able to promote changes in the innovation system by favouring greater inter-institutional collaboration. Government agencies were thereby granted an increasing role in setting the research priorities and selecting how much organisations

[50] http://www.nesta.org.uk/project/innovation-growth-lab-igl

and individuals would receive in terms of funding: "Governments will tend to set research priorities that are relevant to the country's economic and social needs but also consolidate research excellence" (OECD, 2011). In particular, funding for basic science is typically distributed through open, bottom-up competitive mechanisms, where researchers are free to propose research projects that are then assessed by their peers. Funding for applied research, however, is typically distributed alongside pre-defined research priorities determined by the funding organisation, with different degrees of openness and participation; the proposals are in this case assessed by either peers or civil servants.

This shift brings opportunities and threats. It implies, on the one hand, greater risks for short-termism and low prioritisation of basic research; on the other hand, it provides opportunities in terms of greater systemic interactions with other actors in the ecosystem.

What is clear is that the change in the funding system has an influence on the behaviour of institutions and scientists. Even governance changes that are directed only at institutions have an indirect impact on scientists. For instance, performance metrics used for the funding of institutions are typically reproduced to manage the relation between the researcher and the institutions: as a result of the new competitive-based funding framework for institutions, research organisations "have responded by incentivising desirable behaviours on an organisational level" (OECD, 2011). There is ample evidence that the shift towards a competitive system has affected the behaviour of scientists, who typically develop specific strategies for selecting external funds and for adapting their research (Laudel, 2006).

This deep connection between the way science is carried out and how it is funded was largely present in the discussion over the "Mode 2" system of science. (Baber et al., 1995) argue that science has changed from traditional Mode 1 (long-term and curiosity driven) to the Mode 2 (temporary, context-driven, problem-focused and interdisciplinary) system of science. Mode 2 science is carried out by a wider variety of actors (not just traditional researchers), it is funded by a greater diversity of players (beyond government) and it is embodied in the expertise of researchers more than in publications. While it is out of scope to deeply analyse these concepts here, it is remarkable that the driving forces of this change are attributed to issues deeply related to the funding system:

- The increasing role of government in steering the research priorities in order to "meet identified social and economic needs";
- The commercialization of research and the importance of industrial funding;
- The emerging accountability and quality assessment of research.

This is the background of the current competitive funding instruments, exemplified by the European Framework Programme for Research and Technological Development, first launched in 1984.

1.1.2 The challenges of competitive research funding

This new institutional setting based on competition and accountability, while broadly recognized as successful, has attracted criticism in terms of its fitness-for-purpose. This criticism has in particular addressed how funding priorities are set and how research proposals are evaluated.

Several evaluation exercises on the Framework Programme have detected a strong "usual suspects" effect and the difficulty to involve new players in the competitive funding instruments: "the established, major stakeholders on the European stage dominate these large instruments and the involvement of these 'usual suspects' greatly increases the likelihood that results will be implemented. However, the Framework Programme contains limited countervailing activity that

would stimulate disequilibrating, disruptive technologies and innovations that can unseat the established players and unleash the development of new industries" (Bravo, 2010).

Researchers spend much time to assess the excellence of proposals from which only a little portion can effectively received funding. But not only reviewers, but also researchers spend much time identifying funding opportunities, building consortia with other stakeholders and writing and submitting grand proposals. Just to summarize some of the many critiques that the traditional method of grants and peer review receives, see below some mentioned in (Guthrie, Guerin, Wu, Ismail, & Wooding, 2013):

- It is an inefficient way of distributing research funding: high bureaucratic burden on individuals; high cost; doubtful long-term sustainability
- It does not fund the "best" science
- It is unreliable: ratings vary considerably between reviewers
- It is not accountable: review anonymity reduces transparency
- It is not timely: it slows down the grant award process

In particular, the criticisms concern the priority setting phase and the proposals evaluation.

Proposal phase	Strategic Programme Planning: The funding organisation decides on a broad set of research priorities before allocating a fixed amount of resources to each programme area. Isolated applicants: Applicants submit research proposals to the funding body that has been developed alone or in teams. Passive call for funding: The funding body releases a call for proposals so that applicants can submit applications by a specific deadline.
Evaluation phase	Ex-ante: Research outcomes and expected deliverables are prospectively defined in project proposals. Ranking: The panel makes a group decision on which of the proposals presented receives funding, and money is allocated as a grant.

Several reports and analyses have criticized the dynamics of already existing thematic and top-down funding research programmes for their lack of ability to answer to scientific and socio-economic challenges.

As (Auer & Braun-Thürmann, n.d.) point out, when analysing the practices of funding agencies (such as the European Union, national or federal ministries or private foundations), we gain the impression that the measures used to trigger societal impacts are not always very efficient: funded research projects are often too large to meet funding agencies' expectations that big impact requires big investments. But large research projects are very hard to plan a priori. Scientists tend to write very detailed proposals to maximize their chances to get funded - but proposal writing skills do not always correspond to research capacity. Evaluators and reviewers of a project struggle to anticipate the potential impact or success of a project. Collaboration and interdisciplinarity are success factors for innovation (Hollingsworth, 2002), but each additional partner also increases coordination costs and management overhead.

1.1.3 The emergence of alternative funding

In coincidence with the emergence of the awareness about the limitations of competitive funding, we have recently witnessed the emergence of a set of novel research funding schemes. In some cases, new funding mechanisms emerge as a deliberate response to the limitations of competitive

funding: the increasing adoption of open mechanisms such as FET is designed to better accommodate the complexity of the innovation process and enable disruptive innovation; inducement prizes help breaking the "usual suspects" problem and reduce the asymmetry of skills between researchers and funders by rewarding concrete results rather than project proposals(Beckert, Friedewald, & Schaper-Rinkel, 2012). In other cases, the new funding mechanisms are the reflection of long-term and society-wide trends towards a more active role of private citizens in co-producing public services (e.g. philanthropy and crowdfunding as part of the crowdsourcing movement) and the move towards government as a platform rather than as a service provider (Shirky, 2009).

What these new funding mechanisms show is that traditional government players deliberately choose to refrain from defining the specific directions of research and opt for a more open, demand-driven approach, where the answer to the problem can come from unexpected sources and disciplines. On the other hand new players such as wealthy individuals and "the crowd" start to play a major role in science funding. Bill Gates (Microsoft), Eric E. Schmidt (Google), and Lawrence J. Ellison (Oracle) are among hundreds of relevant donors who are shaping the priorities in science for today and the coming years. Small contributions from the public (the crowd) are shaking the panorama in science funding, the priorities and daily-life of researchers. Crowdfunding platforms such as Kickstarter and IndieGoGo, well established for raising money for political causes, the arts and charity, start to be used to fund research.

In the diagram below, we provide an initial schematic overview of the funding mechanisms. The grey cells fall within the scope of the research addressed in this study.

Funder Strategy	Government	Non-government
Prescriptive, roadmap-based	Traditional FP7 funding	Traditional philanthropic funding with strict roadmap e.g. banking foundations such as La Caixa (ES)
Open, challenge-based	FET-open, inducement prizes in Horizon 2020, challenge.gov	X-prize , Kickstarter, new individual philanthropists, e.g. Bill Gates foundation

Table II.1: Initial overview of the scope of the study

While these mechanisms did not always emerge as a deliberate answer to the challenges of competitive research funding, we will see that they are often relevant to address these specific challenges.

1.2 Objectives of the study

This study aims at analysing these new mechanisms in order to address some key questions:

1. What are the key features of alternative funding mechanisms, and are they available in Europe?
2. How to they work out for researchers and research institutions?
3. What are the opportunities and challenges for EU policy?

As a result of the initial literature review, the following research hypotheses were explored during the following phases of the study:

The new research-funding mechanisms have consequences for the knowledge production of scientists; for instance, they privilege more applied science versus basic science and more

experimental research versus theoretical research. It is also more focused on later stages research (closer to commercialization). It also requests more short-term research instead of long-term research.

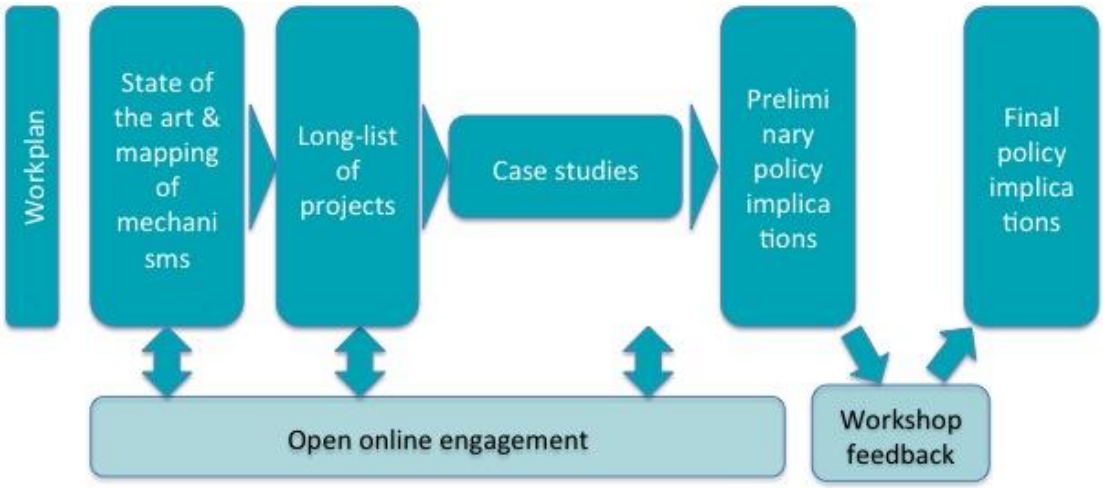
Furthermore, these new research-funding mechanisms have also implications for the skills required by scientists: They request communication and sales skills more common to entrepreneurs nowadays, in order to sell their research project to the crowd or to private parties. These new emerging mechanisms are presupposing some changes in the way research results are communicated, for instance, with regard to scientists' publication practices. Researchers acquire communication skills themselves or ask for some support when trying to post the information about their research in a crowdfunding platform, or look for some mentorship when trying to sell their research to private donors.

Other possible implications to be explored are the perceived quality of the research results by research community (increased or decreased compared to the traditional methods of funding) and if these new mechanisms privilege more risky and innovative research.

1.3 Architecture of the methodology

The architecture of the methodology was designed as a set of sequential steps, accompanied by a transversal activity of open online engagement that cuts across all activities.

Figure II.1: Overall architecture of the methodology



The architecture starts with a state of the art and preliminary mapping of 67 alternative funding mechanisms. From the first mapping, a long-list of 21 projects funded under alternative funding instruments was identified. From this list of 21 projects, 4 case studies that are analysed in the present report have been selected. Those case studies were analysed to derive the implications for researchers, research institutions and EU policy.

The case studies were carried out via desk research and in-depth interviews with the main referent (project manager or equivalent). Interviews have been carried out in October/November 2014 using semi-structured questionnaires. The preliminary results of the project were discussed in an expert workshop organised by JRC-IPTS in October 29-30 in Seville, Spain.

2 FINDINGS

In this section we present the key findings of the study. In the first part we outline the results of the literature review for the different instruments. We then present the results of our mapping exercise, followed by the individual cases.

2.1 Defining alternative funding

The working definition for "alternative funding methods" used the following wording: funding "outside the traditional funding systems (i.e. not the conventionally known funding agencies that steer research agenda, performance and scientific quality)". In the first part of the study, this definition was further specified and the first distinction between the nature of the funder and the nature of the funding mechanisms was already presented in the introduction:

- The nature of the funder can be governmental (traditional) or non-governmental, in particular philanthropy and crowdsourcing (in the original definition: "not the conventionally known funding agencies")
- The nature of the mechanism can be highly prescriptive or open and non-prescriptive (in the original definition, agencies that do not "steer research agenda, performance and scientific quality").

The distinction regarding the nature of the approach deserves further analysis. As the working definition refers to: "steer research agenda, performance and scientific quality", we then consider that this definition includes two different phases of the "research funding cycle":

- The identification of research priorities on which project will be funded;
- The selection of project proposals to be funded.

Let us start from the second phase. The selection of project proposals has received considerable attention, since it has become clear that existing assessment methods tend to favour the skilled proposal writers rather than the actual best researchers. Hence, some new mechanisms have been experimented such as:

- Alternatives to peer review (Guthrie et al., 2013);
- Selection based on CV and publications rather than on project description;
- Casual assignment of initial grants (e.g. lottery) and multi-stage funding based on actual results (Bollen, Crandall, Junk, Ding, & Börner, 2014).

The first phase, the identification of research priorities, has received even greater attention in the literature. In the last 20 years, mainly due the increased strategic importance of research funding and of budgetary constraints, research priority setting has become more and more important in government (OECD, 2003). Governments increasingly need to demonstrate impacts of research and show its relevance for broader policy objectives (e.g. health policy, climate change). Hence, they tend to increasingly set strategic priorities. This creates tension with the necessary freedom of curiosity-driven research, as true disruptive innovation cannot be properly evaluated by existing decision-makers, precisely because of their disruptive nature. As (Gilman, 1995) puts it, "imagine the gas-lighting industry reviewing Thomas Edison's application for government funding to develop incandescent lighting."

Thus the permanent tension between top-down research steering and bottom-up open research has been permanently present in research policy debate.

We can illustrate this debate by identifying two axes. On one axe, we have top-down research priority setting as opposed to bottom-up open research funding (with no ex ante identification of

priorities). On the other, we have science-driven research versus market-driven approaches, depending on whether the directions of research are set by the curiosity of the researcher or by the final users.

Based on these two axes, we can formulate 4 cases, illustrated in the image below. Our study focuses on the two lower quadrants.

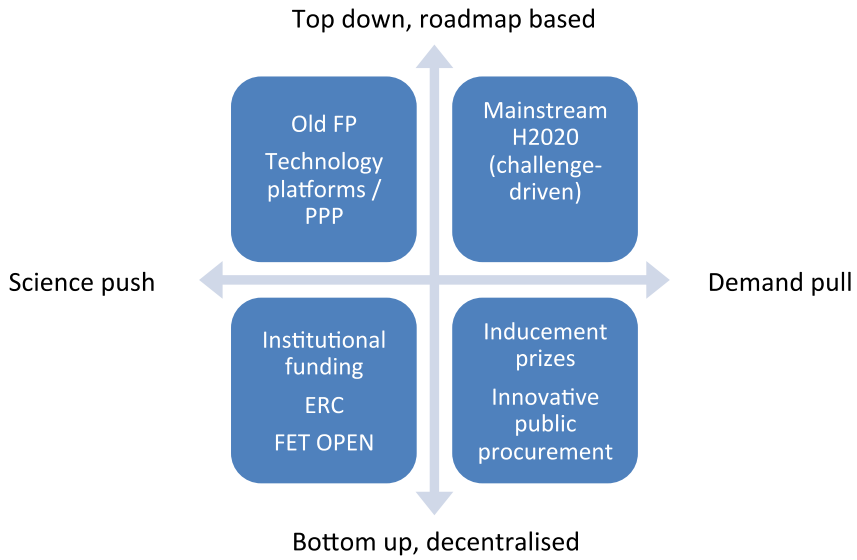


Figure II.2: conceptual model for research priority-setting

Traditional research programmes, such as the Framework Programme before the changes introduced by Horizon 2020, were typically strongly steered centrally (top-down) and by a technology push approach (equivalent to science push, but "pushed" by industry rather than by researchers). The novelty of Horizon 2020 is a stronger emphasis on demand-pull, so that the whole programme is built around "challenges".

Our focus lies in the two bottom quadrants. Not all bottom-up open research is equal. We distinguish between open and science push research, such as the European Research Council funding instruments or the FP7 FET OPEN mechanism, which focus simply on scientific excellence without pre-defining the research priorities. On the other hand, we also identify many open and demand pull mechanisms, such as inducement prizes and pre-commercial procurement, where the final users set the terms of the problem to be solved, but the solution is not pre-determined and can come from many different approaches/disciplines.

In summary, the conceptual model can be structured as a tree that defines the key features of alternative funding.

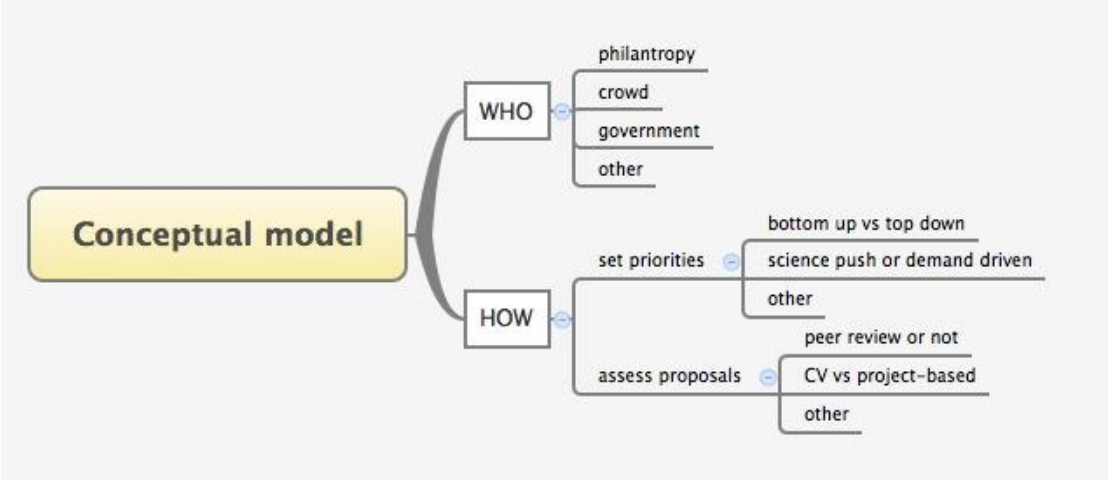


Figure II.3: Conceptual model

In summary, by "alternative funding" we mean competitive research-funding mechanisms that fulfil any of these cases:

- Are led by non-governmental organizations; OR
- Set research priorities in an open way without strong identification of research priorities; OR
- Select proposals through other means than peer review of the projects.

2.2 The state of the art

2.2.1 Crowdfunding

We have recently seen the emergence and growing popularity of crowdfunding platforms to support entrepreneurial and business ventures, charities and social causes. According to industry estimates, crowdfunding campaigns are estimated to reach 5B$ in 2013 and 10B$ in 2014.[51]

Recently, the crowdfunding model has expanded its scope to science, both in generic crowdfunding platforms and with the launch of platforms dedicated to science crowdfunding. Researchers have started raising money for their work directly from the public through crowdfunding campaigns. Examples like Experiment.com or Petridish.org in the US are supporting pair researchers to carry their research with individuals interested in backing their work. RocketHub, Consano, SciFund Challenge are just examples of a long list of crowdfunding platforms devoted to scientific research today.

Some powerful examples in Europe include Science Starter, which is the first German crowdfunding community for science. Science Starter is sponsored by the Association for German Science. Projects have 30 days to win a certain number (based on target funding) of fans from the registered community and receive feedback to improve their proposal. If enough fans are won, the project can proceed to the funding phase. Another relevant European crowdfunding platform is Sciflies.org, which allows donors to connect with scientists working in their fields of interest. A person can view the research opportunities, choose his favourite and send a donation. When enough donors signs in, the research begins. Donors will stay updated on the progress and final results.

[51] https://www.fundable.com/learn/resources/infographics/economic-value-crowdfunding

On the other hand, in the US and Australia, since 2012 universities have also been starting their own crowdfunding efforts as well, both for funding students projects and research, by using ready-made white-label platforms.. The projects on these platforms tend to be rather small, with an average funding size of about 7.000 $ (Dragojlovic, 2014).

The USEED system in the USA is a powerful example of this trend, showing how universities are collaborating with the crowd. USEED works with institutions of higher education to help redesign philanthropy for research. According to edSurge magazine: "The USEED system connects with university's existing alumni management systems. Students, faculty and staff looking to raise funds for "experiential learning" projects, such as participating in an Engineers Without Borders project, launching a company, or raising awareness for a LGBT club, can submit a project through the university. Approved projects are visible to the alumni network, and donations can be made to the university on behalf of that project".

In Europe, we are seeing the emergence of new crowdfunding initiatives by universities as well, although it is still in its infancy compared to the trend in the US and Australia Fondazione Fondo Ricerca e Talenti from the University of Turin (Italy) for instance, has set up a crowdfunding platform to boost its fundraising activities and to support research projects from its young researchers (see more in the section of case studies). Another example is the University of Groningen in the Netherlands, who has launched a crowdfunding site to support their research communities.

Not only universities are joining the wave, also philanthropies and non-profit organisations are creating their crowdfunding sites. The US-based platform Consano, for instance, lists a variety of research projects on its site and makes them available to patients and other conscientious backers to donate to projects they find relevant. According to Techcrunch, Consano was founded by Molly Lindquist, a cancer patient who survived: "Lindquist told us that she is a breast cancer survivor herself, so the roots of Consano come from a very personal place. She realized when she was diagnosed that she wanted a way to provide direct funding to research about the specific gene that may have triggered her ailment, which is the same gene her two young daughters also carry. Organizations such as Susan G. Komen for the Cure are wonderful for getting the word out about breast cancer and funding general research, but Lindquist also wanted a way to provide direct support to projects herself. After lots of discussions with medical professionals and research institutions, Consano was born"

.

Some relevant and similar examples in Europe have also emerged. MyProjects from Cancer Research UK has emerged to support Cancer Research UK's life-saving work. People choose a project that means the most to them and see the impact they can make. The way it works is very simple: people first choose the cancer they want to defeat. They find an area of work that is relevant and interesting to them. Once selected, they make a donation and share their motivations for supporting with other members. At this stage they can use the site to spread the voice. For instance, they can set up their own fundraising page and invite their family and friends to donate together and support it. Finally, they can stay up to date on the progress of the research project by visiting the project page regularly to watch the donation's total reach, its target and to keep up to date with the project developments.

Another strategy of other non-profits and philanthropies has been to join already existing crowdfunding sites to support their research interests.

When analysing all these crowdfunding platforms, it is important to highlight the difference in terms of approach, financing models or commissions. There are two basic models for funding research in crowdfunding platforms. In the "all or nothing" model, money is only collected from contributors if the project researcher's fundraising goal —X amount of money raised by a specific

date — is met; if the goal is not met, no money is collected. In the "keep it all" model, collected funds are turned over to the researcher regardless of whether the project goal is met. Concerning the commissions, crowdfunding platforms are not free. They expect to get an average of 8% to 10% of the funds collected by the research team, so there are some underlying business models for the operation of such services.

The EC has acknowledged the opportunities of science crowdfunding to offer a flexible way to finance R&D, and also increase public engagement in science and research (European Commission, 2014).

As any funding model for research, crowdfunding also has its critics. The growing popularity of crowdfunding to back research projects has been accompanied by an increasing literature and posts about the negative effects of this new model. One of the main critiques by the research community concerns the difficulty to screen the projects and detect possible fraud or the quality assurance of the research projects and results. Online funding decisions are not in the hands of experts, the research community or peer review, instead it is the crowd and general public who decides, which research project they think most important or relevant according to their priorities and interests. Responding to this critique, other researchers have justified that crowdfunding has the potential to enable feedback mechanisms to help scientists to target interested parties to fund their research and this allows for greater transparency and accountability.

This is part of a more profound critic to crowdfunding that argues that these kind of platforms channel money not to excellence in research but to commercial and marketable projects.

2.2.2 Philanthropy

In a context of economic crisis and governmental cuts, philanthropy has started to be increasingly important for carrying out research. Although philanthropy has historically helped researchers, it has generally relied mainly on government grants and industry support. However, the increasing competition for funding from all sources has increased the popularity of philanthropy within the research community.

Private donors are forming a growing part to the support of science. For instance, in donations from US foundations to science, technology and medical research, numbers have grown from 793 million dollars in 1999 to 1.7 billion dollars in 2010, according to figures from the Foundation Center, an organization based in New York that analyses information about philanthropy.

Also the literature on the role of philanthropy in science and its different models and approaches is growing. Some relevant and recent articles in that field are Christine Letts, William Ryan, and Allen Grossman's "Virtuous Capital: What Foundations Can Learn from Venture Capitalists", and Michael Porter and Mark Kramer's "Philanthropy's New Agenda: Creating Value". These have been followed by an unprecedented amount of research, teaching, and writing on the subject, as well as the launch of the Stanford Social Innovation Review and The Foundation Review, blogs such as Sean Stannard-Stockton's Tactical Philanthropy, and new academic research centres at Stanford, Duke, and the University of Pennsylvania.

There is a diverse number of models of venture philanthropy for research, which includes individual partners with academia and industry to invest in early-stage trials (e.g. drug development), the formation of non-profit foundations and partnerships with other entities to work jointly on shared research and development goals, as well as voluntary organizations (e.g. in health research discipline). It is important to highlight that disillusioned with the slow pace of most university research, philanthropists are redirecting their research investments to non-academic centres, think

tanks, and alike, which depend on that revenue and are more likely than universities to produce what is wanted, and in a timely fashion (Katz, 2012).

Philanthropies have innovated in the way they allocate their resources to research. The Internet has enabled advances in communication among funders, grantees, and others, which in turn has enabled great advances in the way they operate and manage (Paul Brest, 2012). Moreover, for the most part the new foundations (whose leadership is frequently drawn from business) have turned to "strategic" grant-making geared to "effectiveness". Traditional grant giving was unfocused, meandering, and ineffective, they believe. Philanthropy has therefore increasingly been reconceptualised as something akin to venture capital investing (Stanley N. Katz, 2012).

Some examples of innovations by philanthropists at European level are Welcome Trust in the UK, which supports the brightest minds in biomedical research and the medical humanities, with the aim of improving human and animal health. They offer a wide variety of funding schemes, including a grant model that integrates mentorship. Once candidates submit their application, they receive an acknowledgement and are assigned a Grants Adviser relevant to their research area, who will be available to support them through the application process and after award. It has a high success rate: On 1 October 2013 they were supporting 2954 active grants with a total value of £2456 million. Of these, 2364 grants with a value of £2151m were awarded through their Science Funding division, 465 grants with a value of £91m were awarded through our Medical Humanities and Engagement (MH&E) division and 125 grants with a value of £214m were awarded through their Technology Transfer division.

Philanthropy is a great opportunity to researchers. A powerful example is for instance the Rockefeller Foundation. As William H. Schneider highlights in his article (Nature, May 2013), the influence of the Rockefeller Foundation on the history of science and medicine has been profound. It has supported research by leading international scientists, helped to create and modernize the world's major medical schools and established the infrastructure and model of global-health programmes to combat diseases. In the first half of the twentieth century, the foundation set the standard for big philanthropy, invented the grant proposal and implemented a worldwide system of fellowships to train young researchers.

However, raising philanthropic support it is not easy for researchers and it requests some skills. Many of the skills needed do not come naturally to scientists. Scientists are enrolling more and more in classes to train them to raise private money.

There is also a growing literature about the pitfalls of philanthropic money for research. Based on the literature, the main reasons are highlighted below:

- **Research (especially on health issues) as public good** to be preserved without intrusions: (Bowman, 2012) reports Mark Harrington, Director of an AIDS advocacy think-tank which has received funding from the Foundation of Bill and Melinda Gates, explaining that democratically accountable governments should solve global health problems supporting research, but that in the situation of lack of (or not sufficient) governmental investment, philanthropists' money is needed. "Medical research and global health are both public goods: the benefits accrue to everyone, even though only some people pay for them. Industry will only do it if they see return on investment; and philanthropists, well, it's better Gates doing this with his money than what the Koch brothers [funders of the right-wing Tea Party political movement in the US] are doing with theirs. Do I think it's good that we live in a world where some people have so much money? Not really, but I don't get to choose that. We have to work with the world the way it is" .
- "**Venture capital" mind-set for supporting research** (goal oriented): Private donors usually expect some concrete results and deadlines from the researchers they are funding. If you want to sell your research, sometimes you have to agree to set deadlines. And this is something that many scientists resist, because science rarely goes according to predefined plans. When it does

not, fund-raising experts say that it is best to acknowledge the failure and stress the importance of the lessons learnt. As Stanley N. Katz (2012) explains in his article, foundations have tended to reduce the number of programme areas in which they give funds, to be more precise and detailed in their programme objectives, to restrict project time frames, to establish benchmarks for continued financing, to evaluate grantees in a more precise manner, and to form partnerships with grantees in managing their projects. Paul Brest, the very able president of the William and Flora Hewlett Foundation, has summarized the new position: "The fundamental tenets of strategic philanthropy are that funders and their grantees should have clear goals, strategies based on sound theories of change, and robust methods for assessing progress toward their goals."

- The **powerful lobby of philanthropists**: Warren Buffet (the business magnate currently ranked the world's third richest person) pledged $31 billion in company stock to the Bill and Melinda Gates Foundation. Combined with Gates' committed assets of over $30 billion, this made it arguably the biggest philanthropic venture ever. That year, its Global Development Programme extended its activities to agriculture and economic development and, with projects multiplying, Gates began working full-time on philanthropy in 2008. Dr David McCoy, a public health doctor and researcher at University College London and an advisor to the People's Health Movement stated that: 'Through its funding it also operates through an interconnected network of organizations and individuals across academia and the NGO and business sectors. This allows it to leverage influence through a kind of "group-think" in international health.' In 2008, the WHO's head of malaria research, Aarata Kochi, accused a Gates Foundation 'cartel' of suppressing diversity of scientific opinion, claiming the organization was 'accountable to no-one other than itself '.
- **Intrusions to academic research**: One of the main pitfalls usually claimed by researchers is that donors used to attach strings to their donations. Some researchers do not want to pursue this road to guarantee their independence and no intrusion from private parties to their research agenda. As one of many examples in this respect: When Charles G. Koch's Charitable Foundation in Virginia agreed to fund a faculty position in economics at Florida State University in Tallahassee, they asked the right to determine the criteria used to pick a professor, and to veto candidates they did not like. The university accepted the terms in 2008, but has argued that input from the foundation during the hiring process has not compromised its academic integrity. Another example is found in Spain, was when the Vodafone Foundation agreed to fund a research centre (Innovation Institute for Human Wellbeing- I2BC), they agreed with the government certain conditions, for instance their intervention in the selection of the Managing staff of the organization.
- **Ethics**: There are many physicians that are reluctant to ask their patients for economic support to carry their research, for instance. Other researchers are also reluctant to be funded by companies who have a doubtful behaviour with society (the impact of their business to environment or people).

2.2.3 Open funding mechanisms

Many studies stress the importance of promoting funding research programmes that are more collaborative, stakeholder-driven and bottom-up.

"Open research" is defined as being novel, foundational (opening new paths of research), transformative, high-risk, focused on new ideas, collaborative and multidisciplinary and being open to partnering on a global scale.

Several national and regional agencies are extending the practice of open research funding models in Europe, as it is reflected in the mapping described in the next section. Some examples of these alternatives mechanisms include, as highlighted in (Bollen et al., 2014):

- Milestones: The funder breaks up big challenges, such as developing a cure for a disease, into a road map of smaller questions. Researchers then compete to answer these smaller questions. This allows a strategic, stepwise approach, and easier judgement of whether particular research aligns with the funder's aims. But success in achieving research objectives relies on the accuracy of the road map. One of the most popular mechanisms within this category is inducement prizes.
- Unconstrained excellence: Instead of deciding on specific research priorities, the funder directs resources based on the excellence of the researcher, who is then free to pursue his/her interests. For instance, the Danish National Research Foundation offers research funding without a fixed formula. Candidates from any discipline can be selected to carry research in fields ranging from medieval literature to biochemistry.
- Sandpit: Researchers and a diverse group of experts come together for a workshop. Through brainstorming sessions and interactive collaboration, researchers refine ideas. At the end of the workshop, funding is awarded to the best proposal. This process fosters transparent peer review and encourages substantive changes to improve the proposed research.

One inspiring example of the sandpit mechanism comes from the Takeda-Techno Entrepreneurship Award in Japan. Competing scientists are invited to participate in three successive online working sessions to present and discuss their proposals. A selection committee makes the final decision. The awards are as follows: for the first one, up to 7 million yen per year are awarded, and up to four finalists are awarded up to 500,000 yen per year. The winners should be commercial applications of engineering that boost social or individual well being.

Another example, this time from Europe, is IDEAS Factory run by Engineering and Physical Sciences Research Council (EPSRC) in UK (see more in the section of case studies). This mechanism promotes high-innovative and high-risk research. According to its self-description, the aim of the IDEAS Factory is to identify and provide funding to potentially transformative research. Topics can be in any area, but the common feature is that they need a new dimension in thinking. It consists of a real-time peer-review in the sandpit exercise: the selection process is a process of developing project ideas in a unique way. The track record of proposers seems to be of secondary importance.

The main novelty of the approach is that it consists of a 5-day workshop, where 20 to 30 people are invited. These participants have previously participated in an open call for research projects to address a grand challenge question. The sandpits are led by a director with the support of a group of international experts (mentors), as well as stakeholders from industry or society chosen by the director. All of them (director, mentors and stakeholders) are the reviewers of the proposals developed by the participants of the workshop. They act as impartial referees in the process.

Inducement prizes: Within the open funding mechanisms, one of the most popular ones is the inducement prize, which corresponds to the milestones approach explained above. Companies and governments have set up "challenges", where the financial reward goes not to the best proposals, but to the innovators who come up with the best working solutions.

Examples include the famous DARPA challenge for the self-driving car, or the recent Australian prize for the best algorithm to identify patient at risk (http://www.heritagehealthprize.com).

However, we did not find only US examples, but the European Commission has also adopted them. Inducement Prize Contests are a new instrument introduced under Horizon 2020. The EC offers a reward for the completion of a set of technological challenges that have not yet been achieved. They are a way of spurring interest in a particular issue, helping to attract new dynamic innovators to the area, mobilising additional private investment for research, and stimulating interest among the general public. In 2012 the European Commission already piloted an Inducement Prize offering 2 million euros to inventors who would develop a way of keeping vaccines stable in ambient temperatures. The ICT sector – being dynamic, fast moving and attractive to many of this century's

best innovators – has been selected for the launch of several Inducement Prizes under Horizon 2020. The European Commission's plan is to launch three ICT-related Inducement Prizes in 2014-2015.

According to literature (Mckinsey, 2009;Stallbaumer, 2006), the main benefit of this type of mechanisms is their capability to reach out a large number of innovative ideas, involving different type of stakeholders that are not usually involved in traditional funding mechanisms from government. They are potentially able to attract the best innovators because they reward concrete results, not proposals, and they may attract a far superior number of high-quality results than traditional grant systems (Mckinsey, 2009;Stallbaumer, 2006).

The key advantage lies in the open approach for inducement prizes, which fosters diverse participation and serendipitous innovation. There is no need to select in advance from a pool of prospective participants who are the most likely to produce the desired result. Instead, the competitors determine for themselves whether they believe they can meet the terms of the prize taking into account the pre-investment needed. As a result, unconventional solutions, which are often shunned because they are deemed too risky, are allowed to compete equally against less innovative approaches.

It is also effective in translating research into marketable products or services. For example: the Global Security Challenge winner in 2007 was NoblePeak Vision from Massachusetts, which has developed breakthrough night vision surveillance camera cores and components. They raised $12 million in a subsequent funding round, led by Chart Venture Partners of New York.

However, literature shows that Inducement Prizes have also their limitations. As Abdullah Gök explains: “there is a consensus that innovation inducement prizes are not a substitute for other innovation policy measures, but are complementary under certain conditions. Prizes can be effective in creating innovation through more intense competition, engagement of wide variety of actors, distributing risks to many participants and by exploiting more flexible solutions through a less prescriptive nature of the definition of the problem in prizes. They can overcome some of the inherent barriers to other instruments, but if prizes are poorly designed, managed and awarded, they may be ineffective or even harmful”.

2.3 Mapping the landscape

This section provides an analysis of the mapping exercise carried out through a desk research activity, which is aimed at gathering the widest set of examples of alternative funding mechanisms for scientific research. We provide here an overview of the distribution of mechanisms by country, typology and main disciplines for each mechanism and approach.

Obviously, this is not designed as an exhaustive mapping, nor is it statistically representative. It serves the purpose of shedding an initial light on the landscape for alternative funding in Europe – mainly to detect whether such mechanisms exist and what their main focus is. Additionally, the mapping helps to identify the case studies to be carried out.[52]

2.3.1. To what extent are alternative funding mechanisms for scientific research present in Europe?

The mapping includes a total of 67 alternative funding mechanisms, covering 22 countries, among which 45 are applied in European countries and 22 in non-European countries. With regard to the EU Member States the largest number of mechanisms is found in the United Kingdom, followed by

[52] The mapping is on-going and available online at: http://scifund20.wordpress.com/2014/10/07/give-your-contribution-to-the-mapping-of-alternative-funding-mechanisms-for-scientific-research/

Spain, Germany, Scandinavian countries, Austria and Italy. With respect to non-EU countries, the ones with the highest number of these mechanisms are found is the USA, followed by Canada and Australia.

Europe	Number of mechanisms	Non Europe	Number of mechanisms
Austria	2	Australia	2
Denmark	2	Brazil	1
EU	1	Canada	3
France	1	China	1
Germany	6	Japan	1
Italy	2	South Africa	1
Netherlands	2	USA	13
Poland	1	**Total**	**22**
Portugal	1		
Scandinavia	1		
Slovenia	1		
Spain	9		
Sweden	2		
Switzerland	1		
United Kingdom	13		
Total	**45**		

Table II.2: Geographical coverage of alternative funding mechanisms

This mapping shows clearly that alternative funding mechanisms are already today a visible presence across Europe, rather than an option for the future. Obviously this concerns only the availability of such instrument, not their importance or impact.

2.3.2 What are the types of funding instruments mapped?

The desk-based research was able to gather a balanced number of cases across different typologies.

Despite the growth in the number of European crowdfunding platforms as an alternative funding method for scientific research, the mapping highlights how philanthropy remains the main alternative mechanism used in Europe. In a context of relevant governmental cuts to science funding, private donors are becoming a growing source of support to science, as hinted by the evidenced in the mapping In our small-scale scoping study, philanthropy is the main instrument found, especially in the United Kingdom and Germany, followed by crowdfunding and government instruments. It has to be noted how crowdfunding for science has a limited geographical distribution compared to the other two instruments, as it is mainly present in the United Kingdom and Spain.

Table II.3: Typology of funding instruments

Europe	Government bottom-up mechanisms	Philanthropy	Crowdfunding
Austria	1		1
Denmark		2	
EU		1	
France	1		
Germany	1	3	2
Italy		1	1
Netherlands	1		1
Poland		1	
Portugal		1	
Scandinavia	1		
Slovenia	1		
Spain	1	2	6
Sweden	1	1	
Switzerland	1		
United Kingdom	2	7	4
Total Europe	11	19	15
Non Europe			
Australia	1	1	
Brazil	1		
Canada	1	2	
China	1		
Japan	1		
South Africa	1		
USA	3	6	4
Total Non Europe	9	9	4
Grand Total	20	28	19

2.3.3 What disciplines are covered?

In most cases (47), the organizations fund scientific research projects in multiple scientific fields. However, when a discipline is indicated, Health is clearly prevailing (14 mechanisms).

There is not a big difference between the mechanisms: all mechanisms tend to be open to all disciplines. The only striking correlation is the strong focus on Health research by philanthropic mechanisms (11 mechanisms).

Discipline	Crowdfunding	Government	Philanthropy	Total
Health	2	1	11	14
Technology/Engineering	1	3		4
Natural Sciences	1	1	2	4
Social Sciences			1	1
Not defined	16	16	15	47
Total	20	21	29	70

2.4 Overview of the cases

In this section we present short cases studies, aimed at better understanding how alternative funding mechanisms work, and what are the implications for the scientific community. The cases were selected to allow for a balanced coverage of these criteria: type of mechanisms; project level and mechanism level cases; scientific disciplines; geographical areas.

2.4.1 Case 1 outlook: I Lowe You

	• Example: Crowdfunding a scientific research project • Discipline: Health, rare disease • Platform: Funds4Research, Spain • Money raised: 45038 euros (in 3 months)

"I Lowe You" is a health related research project on an ultra-rare disease called the Syndrome of Lowe. The project completed a successful fundraising campaign through a Spanish crowdfunding platform called "Funds4Research" in June 2013.

Description of the case

"I Lowe You" is carried out jointly by the Asociación Sindrome de Lowe de España (The Spanish association for the Lowe syndrome), Unit 703 of Biomedical Research Centre Network for Rare Diseases of Hospital St. Joan de Déu in Barcelona and the Research Group PSINET from Universitat Oberta de Catalunya (UOC). The research project can be described as a joint effort of both researchers and parents who work together for the development of knowledge of an ultra-rare disease (a rare disease of low prevalence): The Syndrome of Lowe.

In general, the progress of clinical research of rare diseases is held back by the limited access to patient data. Similarly, the general problem in the field of the Syndrome of Lowe is that a doctor or a researcher rarely sees more than 3 or 4 patients in his entire career. This limits the possibilities to "accumulate" personal experience and knowledge.

On the other hand, the families who take care of a patient with a rare disease accumulate a large amount of information on a daily basis. This information can be very valuable for researchers of the disease. Furthermore, the involvement of patients and caregivers in a research project may include some direct psychological benefits. Finally, the inclusion of patients and patient organizations to research in a straightforward manner can help in terms of financial sustainability of research projects on rare diseases and improve release and social awareness.

Crowdfunding platform

The "I Lowe you" project received funding through the Funds4Research platform. Prior to that, the project had not succeeded to attract any other funding.

Funds4Research (F4R) is a crowdfunding platform in Spain. It is managed by a non-profit association that aims to help research projects to seek funding. It also raises awareness on the importance of investment in science and research as a factor in progress and social welfare. The board of Funds4Research is composed by Lluís Amiguet (President), Teresa Ferré (Treasurer) and Manuel Murillo (Secretary).

Funds4research was very involved in the crowdfunding campaign. The duration of the campaign was 3 months and they raised 45.038 Euros. During the campaign, the effort of the coordinator

and the entire research team was considerable in order to mobilize their networks, to provide constant feedback about the project to donors, and to negotiate with media players free space to advertise the project, etc.

Implications for scholars

In the case of the I Lowe You project, the main reason for the research team to apply using a crowdfunding campaign was the past failed grant proposals presented to different governmental agencies and organizations. The benefit of the research proposed to the governmental agencies was always foreseen limited, as the target population is not large enough. So, when competing with other type of research projects in health, there was always another project with larger impact in terms of population that could be positively affected by the results of the project in question.

Consequently, researchers started to explore alternative ways to find funding for their research. The families of the children affected by this disease could help to raise awareness and support the research team to raise money, so a crowdfunding campaign appeared to be a good option to explore.

A large research team has been working together with families and patients in the project. There have been different implications for this group of researchers to apply for crowdfunding in order to implement such a project. A large communication effort has been done not only by the communication team, but also from the coordinator who has been continuously in contact with donors and potential donors to increase the amount of funding. During the fundraising period, she constantly devoted time to explain the project itself, and the progress made so far in order to build trust, which is a key element of any crowd funding campaign to succeed. The interviewees highlight the role of trust in the research team behind the projects as fundamental. Donors have to believe that they are giving money to a serious people with clear objectives and very tangible and feasible results.

The members of team mobilized their social networks in order to achieve the threshold of funding fixed at the beginning of the campaign. Not only Facebook, Twitter and other social networks were used, but the research team was in contact with mass media. Such efforts are to be expected when launching a crowdfunding campaign. The team members compare the efforts to an electoral campaign and highlight the level of stress they suffer in order to get the target. More traditional funding mechanisms do not require such skills and type of activity. This is something one has to take into account when choosing for crowdfunding research activities. This is a piece of advice shared by the research team behind the project.

In this particular case, the research team of "I Lowe You" does not complain about the efforts put in the communication campaign to raise the money, as it served to identify families that had a child affected with Lowe syndrome. So for them, the crowdfunding campaign helped to start the research, even before receiving the actual money, as the attention received was instrumental to gathering more data.

In the case of "I Lowe You", it is impossible to compare the funding received through the crowdfunding campaign with more traditional funding. The main implications to carry the crowd funding campaign, at institutional level, were the investment in the communication campaign and the follow up with donors.

Lessons learnt

For the success of the project "I Lowe You", it was important to have the main researcher with a very good CV. Equally, the hospital's backup was important, in this case, is was one of the most important hospitals for child care in Spain. The lack of information about the disease was filled by

a large communication campaign, in which the efforts of the overall team, families and friends were crucial.

From the project there are many lessons learnt that can be shared. The reasons why the "I Lowe You" campaign succeeded are the following:

- Design of the communication campaign;
- Communication actors engaged in the awareness and crowdfunding campaign;
- Media campaign and mass media: the information published in El Pais (mass media) had a great impact in the crowdfunding campaign;
- Joint effort of families and research team: the role of families was very important to raise money;
- Intensive effort (8 to 10h per day): the crowdfunding campaign implied much more effort than was estimated at the beginning;
- Quality of the research team: It was very important to have a strong research team and a hospital with excellent reputation behind the project. It gave credibility to potential donors;
- Direct application, social impact and sensitive topic for donors: The research topic of the project was very sensitive to the population and it helped to raise money. Potential donors saw that their money would have a great impact in the life of those children;
- Information: in the crowdfunding platform, there is a need for information;
- Payment system: the payment system has to be improved. Elderly people do not want to provide their credit card number online because they do not feel comfortable. They prefer to make a bank transfer.
- Tax incentives: currently, there is no way to benefit from tax incentives when you are donor in a crowdfunding campaign. There is a lack of regulation compared to other type of philanthropic activities, which have tax incentives.

2.4.2 Case outlook: Fondazione per la Ricerca e Talenti

Fondazione Fondo Ricerca e Talenti	• Example: Crowdfunding for students' and young researchers' projects • Discipline: Humanities • Platform: own purpose-build platform, Italy • Money raised: 10.540€ (for 3 projects)

"Fondazione Fondo Ricerca e Talenti" promotes fundraising and support projects for the benefit of young researchers at the University of Turin, Italy. It completed the first successful fundraising campaign for three research projects in 2013.

Description of the case

The Fondazione Fondo Ricerca e Talenti (Foundation "Research and talent fund") is the first University Foundation in Piedmont, Italy. It was founded in February 2012 with the aim of promoting fundraising and supporting the projects for the benefit of young researchers at the University of Turin which is one of the largest universities in Italy with about 70,000 bachelor and

master's students. It was constituted upon the joint initiative of the University of Turin and the Fondazione Cassa di Risparmio di Torino (a local bank) as a result of the reflections of the two parties on the opportunity to create an entity that could catalyse fundraising, while relying on the best practices of University foundations.

The philosophy behind the Fund, which operates exclusively in the Piedmont region, is that all resources are directly collected by the Fondo Ricerca e Talenti and used exclusively for the direct funding of research projects to ensure that every euro donated reaches those who carry out the activity. For this reason, the main bodies, which are the Board of Directors and the Board of Trustees, offer their support free of charge and as such became the first volunteers of the Fund. The core activity of the foundation initially was organised around traditional fundraising events and communication activities.

In 2013, the Foundation started using the opportunities that a crowdfunding platform can provide, especially in the field of humanities. The Foundation therefore launched a crowdfunding platform to complement their activities.

The crowdfunding platform was born with the aim of complementing the traditional funding activities of the Foundation with new fundraising methods for additional initiatives beyond the scope of the traditional funding. In this case, the crowdfunding platform is a process based on a system of cooperative micro-finance. The Fund selects projects proposed by the University research facilities that will be published on the website of the Fondazione Fondo Ricerca e Talenti and are likely to appeal to the community to raise the necessary funds.

The crowdfunding platform has been active from April 2014 until June 2014 for a total of 60 days, with the aim of creating three projects: **CiViLe (Cittadinanza Visioni Letture)**, **HackUniTO**, **Umanesimo Corsaro**. Each project had a target of 3000 euro, and reached an overall amount of 10.540€, as demonstrated in *Figure 1*.

Figure II.4: Project targets

Project	**Description**	**Target reached**
Ci.Vi.Le	Spreading knowledge of the Italian Constitution through a simple, original and interdisciplinary approach, by combining a technical and legal approach. The offline activities of the volunteers, during some of the most important events in the city like Torino Jazz Festival and Salone del Libro, have been essential in order to sensitize citizens to the activities of the Fund.	4.385€
HackUnito	The University of Turin has opened its doors to the public for a marathon of ideas and projects in order to find new solutions to serve the whole community. The main objective of HackUniTo is to activate the energies and fuel the commitment to improve the quality of life, starting from the local community and expanding through collaboration with other organizations in the same area.	3.095€
Umanesimo Corsaro	A conference whose goal was a reflection on the relationships between humanities and other fields such as engineering, neuroscience and computer science.	3.060€
Total		10.540€

Each project was successful, also thanks to several initiatives which attracted donors, such as social media activity, creation of promotional videos and participation to different city events that have made possible the integration between the crowdfunding platform activity and traditional fundraising.

Implications for scholars

The Italian context, which can be characterized by governmental cuts to science funding, has encouraged scholars and volunteers to use alternative funding mechanism for scientific research. However, it is also important to highlight that one of the obstacles to the development of the crowdfunding platform in question has been the university itself. Crowdfunding was initially not seen as a credible mechanism for funding projects nor as a real opportunity to research funding. In the opinion of the Team that led the crowdfunding campaign, it was not straightforward to convince the University of Turin to understand that the crowdfunding is a process involving trust. The mechanism of trust, which develops between members of the team and their personal network of contacts, is critical to the success of projects. An example of this is that every person of each project's team has donated and engaged his or her own network in the campaign in order to convince other people to donate.

The crowdfunding platform in this case can be considered only as complementary to traditional fundraising methods, such as events and communication activities. The crowdfunding campaigns are suitable for reasonably budget initiatives, but one of the preconditions to keep in mind, in order to achieve the target, is a very clear idea, a focus on the target audience and the preparation of a marketing template in advance. In that regard, the marketing strategy has to be profit oriented and consistent in order to be efficient and feasible.

The most promising way to get a sufficient amount of funds is a mix of crowdfunding, traditional fundraising, and self-funding, while it is necessary to keep in mind the differences and advantages that each funding mechanism can bring.

However, the target amount achieved through crowdfunding cannot be set to an unrealistic level. Indeed the initial target amount was set at Euro 10.000 per project, but this amount had to be lowered to €3.000 in order to be achievable.

Furthermore, it is necessary to highlight the important role of scholars' and especially volunteers' personal network, which has proven critical to the success of the projects.

The funding of projects that are not specifically related to health and medicine has always been very difficult to realize. This case, in addition to being the first case of university crowdfunding platform in Italy, has demonstrated that crowdfunding can help to fund projects also related to the humanities.

Implications for institutions

Among the strengths of the Fondazione Ricerca e Talenti is the importance of being the first institution in Italy to offer crowdfunding for universities and also the good relationship with the various departments and the researchers' team. Those links have been further consolidated following the success of the first campaign and will foster deeper cooperation in the next campaign.

The University of Turin has learned many things from its involvement in the process, for instance the importance of the engagement of the research team. If the research team wants to convince people to invest in their research, they have to be the first ones to show their commitment and engagement with their donations. There are still some cultural barriers to face: researchers do not feel comfortable asking people for money to invest in their research. On the other hand, it was hard

for them to understand the importance of being themselves donors of their projects. Other cultural barriers that not only institutions but also the research team has faced are the trust in the person leading the crowdfunding campaign. It is not an easy task to build trust between the people leading the platform and the research team. This is a process that is being built together all along the time during the campaign.

For the institution, the amount of time to be invested in the communication campaign was rather surprising. Compared to traditional funding, crowdfunding demands a lot of energy in its communication strategy.

Lessons learnt

Fondazione Ricerca e Talenti is planning to launch three other campaigns. It is currently selecting together with the University of Turin the next projects to be launched. The intention is to choose projects that can be more sensitive to the population, so that the money raised can be increased. It is still challenging to make this initiative sustainable. Until now, the work from the staff has been voluntary and there is a large network of voluntary people who have helped to raise the money for the past projects. The plan is to increase the number of projects and the amount raised in order to scale up the initiative.

The relationship of trust with donors was of crucial importance for the projects to be successful. The fact that each donor was thanked (via YouTube) has made it easier to establish good relationships with donors, which can be useful for the next crowdfunding campaign of Fondazione Fondo Ricerca e Talenti. With regard to future plans, they will definitely include a new campaign with new projects that will be structured in a simpler way in order to make communication more effective.

Among the key lessons learnt is the importance of having good communication skills and the awareness that the target to aim should be feasible, and also the awareness that for the University of Turin, the crowdfunding platform can only be a complementary way to fund research.
Other lessons learnt are that the cultural barriers still need to be overcome in Europe concerning crowdfunding for research. There is still more awareness needed.

Research projects must further be more sensitive to people's life (e.g. health issues). On the other hand, the team has to be committed for intensive period dedicated to awareness campaign and fundraising (including family & friends). There is a need to build a robust media strategy.

2.4.3 Case 3 outlook: Team Puli

GOOGLE LUNAR XPRIZE puli OFFICIAL TEAM	• Example: Inducement prize • Discipline: Space • Initiative: the Google Lunar XPRIZE challenge • Total budget: 15 M EUR; prize money is 20 M EUR

Team Puli, based in Budapest, is one of the European finalists of the Google Lunar XPRIZE challenge that aims to land a robot safely on the moon.

About the Google Lunar XPRIZE challenge

In order to win, a team must successfully land an unmanned rover on the Moon, travel for a minimum of 500 meters from the landing site and send images back to Earth. This consists of high definition 360° panoramic photographs of the lunar landscape, self portraits of the rover, near-real time videos of the journey of the vehicle, High Definition videos of lunar features and transmission of a cached set of data along with the newly recorded information. Registration was closed on December 31, 2010.

The team should be at least 90% privately funded, therefore with a maximum 10% of public funding

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The first team to complete the mission objectives will receive $20 million, the second team $5 million. Another $5 million will be awarded in bonus prizes, including imaging other man made artefacts on the Moon, roaming the lunar landscape for more than 5km, discovering water-ice or surviving the chilling lunar night, and up to $10 million that can be awarded before a Moon landing for completing terrestrial or in-space milestones. The final deadline for completing the challenge is December 31, 2016.

The intermediate Milestone Prizes, totalling US$6 million, are for demonstrating (via actual testing and analysis) robust hardware and software to overcome key technical risks in the areas of imaging, mobility and lander systems — all three being necessary to achieve a successful Google Lunar XPRIZE mission.

Description of the case

Team Puli aims to land a self-made probe on the Moon by the end of 2016 and thus complete the Google Lunar XPRIZE challenge. The Moon probe will explore the nearby area and send high quality imagery and video recordings of its surroundings and itself back to Earth, as well as to gather scientific measurements.

The mission of Team Puli is to develop the new techniques required to routinely send spacecraft to the Moon, to explore new frontiers and to provide quality services for forward-thinking investors interested in commercializing space.

Tibor Pacher, founder of Team Puli, is a physicist with degrees from Budapest and Heidelberg University. Until 1993, he was mainly involved in research activities; since that he moved to business and public outreach activities for promoting STEM education.

The challenges related to this mission are highly multidisciplinary, from physics to engineering to astronomy issues. It relies on a combination of off-the-shelf components, adapted to resist different conditions. For instance, it will use an “off-the-shelf” Geiger Muller Counter that can travel in space, but they will build a custom microcircuit to send data to Earth.

The prize is worth $20 million, so even in the case of winning, the financial benefit is very much reduced. According to the project funder, “nobody is working for the prize”. The amount is just a catalyser of the effort, to raise visibility and competence. The real goal is to build knowledge, expertise and visibility, and to build a brand for the new company in order to become competitive in the emerging space market. This is how the original Lindbergh prize worked: the $5000 prize was negligible compared to the effort needed, and to the benefits of becoming a leading player in the (then) emerging aviation market.

Team Puli also considers it a top priority to promote scientific thinking and to encourage students in choosing a career in science. Let us hear directly the words of Dr. Pacher, who is also involved in the Icarus interstellar project: “Reaching for the stars is one of the most exciting challenges

humans can imagine, and it is always fascinating to see fellow citizens embarking on such inspiring endeavours. This is especially true in hard times like ours, when our civilization is facing unprecedented challenges: diminishing resources, wars and poverty, changing climate to mention but a few. Project Icarus gives us with its volunteer international collaboration model a strong positive signal for a better future as well and I sincerely hope that its inspirational power helps to reinforce our youth's interest in deep space exploration as well as in STEM – Science, Technology, Engineering, Mathematics – in general".

However, the funding mechanism is far from being the main financial support to the effort. In reality, Team Puli (and most other competitors), while participating in an inducement prize, are mobilizing resources from many different other sources.

- Industrial sponsors are mainly used to receive in-kind donations for products and software licenses necessary to carry out the work. Only occasionally they provide funding.
- Crowdfunding has been used in the initial phase for $40.000 to gather the necessary funding to register for the prize ($50.000) and to procure some radiation equipment (Geiger Muller Counter) for measurement;
- Merchandising (gadgets, etc.) is also frequently used, although still at an embryonic stage.
- Self-financing and voluntary effort: there are about 30 volunteers working as volunteers in their spare time, and two full time employees (the funder) using their own money (investing on the project). Personal wealth is an important enabling factor.

With regard to crowdfunding, it was performed via their own website and platform, through traditional Public Relation effort, via national mainstream media and gathering money via PayPal or a Bank Account, mainly at national level, in the course of 4 years. They tried global platforms such as IndieGoGo, but they were not able to achieve sufficient visibility, which would require a lot of PR effort. For instance, Planetaryresources.com gathered $1,5 million via Kickstarter, mainly thanks to high-profile endorsement of people like Richard Branson – this is needed to be successful.

Public funding is not used by Team Puli. Under the competition rules, they would be allowed to receive up to 10% funding related to achieving the goals of the prize. However, they have not done so at this stage for two main reasons. Firstly, it would require an understanding of the bureaucratic procedures for the different mechanisms, and they would rather invest their time into scientific research instead. Secondly, in the current political context of Hungary, public funding is highly politicized and conflictual, so that the choice to seek public funding or not would be exposed to criticisms from the different parties.

Other teams in the Google Lunar XPRIZE challenge have been successful in gathering additional funding from other sources, such as from philanthropists, risk capital and from public procurement. However, Team Puli estimates that since is not based in the US, this is a more difficult task. Firstly, to receive funding from philanthropists, it is necessary to have a direct contact and extreme credibility by showing concrete results. Secondly, once the meeting is arranged, it is necessary to convince the funder in a very short time. In general, funders' main concern is image and reputation: they tend to fund "safe bets" with top competitors because they want to make sure that the funding has a real impact. The endorsement of high-profile funders is often not even disclosed until the project demonstrates real impact.

Some competitors are also attracting risk capital investment, which again is easier in the US. Also public procurement is used in the US as NASA is pre-purchasing data from some of the competitors. This is not happening in Europe.

What becomes clear from the case study is that inducement prizes are not to be considered as a funding mechanism, but more as an awareness raising activity, whose aim is to trigger additional

investment. This "leverage effect" of inducement prize should be considered as one fundamental factor for participating. Just as prizes are effective in orienting the attention of researchers towards a specific challenge, in the same way they are orienting the attention of other funders, either public or private. Because of the very nature of inducement prize, which have a "winner takes all" approach, researchers typically do not rely on the prize funding only to justify their investment, but use the visibility of the prize to attract additional funding. Indeed, as (Gök, 2013) shows, the amount of the prize itself would not justify the needed effort.

Implications for scholars

The main strategic objective of Team Puli is to build organisational competences in order to become a player in the "space market". The team sees a strong market opportunity ahead, valued by some reports at $1.9 billion during the next decade, following the conclusion of the prize.[53] The global space market is valued at $314.7 billion in 2013, and it is increasingly covered by commercial offering as government are outsourcing many operations. Commercial ventures are now worth 76% of the total market. All market reports indicate that the market is expected to open up to new, smaller players, offering a greater variety of solutions. Participation in the prize is a unique opportunity to gain visibility and to build the team that can serve this emerging market.

The second reason is the public outreach/awareness-raising goal. The team has long been involved in science dissemination activities, such as the Peregrinus-Interstellar initiative on interstellar travel. The team aims to raise awareness and involve more people in STEM disciplines.

Participation is not cumbersome in terms of application procedures: simply presenting a 25 pages paper with the key ideas. The focus is on the quality and feasibility of the project, without any specific ex ante requirement with regard to people and organisations. As such, participation does not require skills beyond those of the challenge itself.
However, the entry fee of $50.000 and the need to work without a dedicated budget for several years are major financial bottlenecks. It is necessary to become highly skilful in fundraising from third parties, or to be endowed with considerable personal funding. Fundraising from private sources implies dedicating extensive resources to PR, either by cultivating it directly or by employing dedicated resources. This communication effort, however, can pay off if one of the drivers of the researchers is awareness raising and scientific dissemination. In other words, there is an alignment between the communication skills and effort needed for fundraising, and the skills and effort needed for scientific dissemination. Hence, crowdfunding is complementary to awareness raising.

Fundraising towards investors and philanthropists, instead, requires robust reputation and management skills to ensure that the money is invested properly. As such, they require somehow different skills from crowdfunding.

In both cases (general public and wealthy investors), the skills needed (for broad communication and investment pitching respectively) appear as complementary to research skills and helpful to the success of the project – not only to the fund raising activities.

On another level, the high visibility of the prize facilitates the gathering of relevant knowledgeable experts and multidisciplinary collaboration; in other words, it helps reaching the critical mass needed to deliver the results. The publicity of the Google XPRIZE reverberates positively on the possibility of the competitors to gather additional funding. It is a reciprocal relation. The more Google promotes the initiative, the more likely the teams are to achieve the goals. At the same

[53] http://lunar.xprize.org/press-release/study-estimates-market-worth-19-billion-google-lunar-xprize-competitors-within

time, Google would not invest heavily in promoting the prize until it is reasonably sure that the challenge will be met, and that the teams are making significant progress.

Because no direct funding is available ex ante, opportunistic behaviour is discouraged and teams are driven by scientific curiosity and long-term entrepreneurial spirit: this leads to the absence of professional "money-chasers" and to the general high quality of the research.

Researchers are also often more willing to share information openly about their progress, because the risk of plagiarism is offset by the strong need to have attention and gather sufficient funding. The general high level of participants creates a more trusted environment of researchers motivated by higher purposes.

Lessons learnt

It is clear that the XPRIZE has managed to stimulate high quality research effort by many teams in this specific area. The interviewee emphasized the important of a large-scale communication effort by the organisers of the prize, which raises the profile and makes it easier for participants to collect the necessary funding. The XPRIZE is an effective catalyser and accelerator of the scientific effort towards commercial space travelling.

Public funding is seen as cumbersome and focussing on processes, while the XPRIZE is extremely simple and agile, focussed on results. However, prizes can survive only together with the other instruments, both traditional and alternative. What is needed is to find the right mix of the different instruments.

2.4.4 Case 4 outlook: IDEAS Factory

ideas FACTORY	• Example: Open bottom-up government mechanisms • Discipline: All • Initiative: Ideas Factory

IDEAS Factory has been launched and is being managed by the Engineering and Physical Sciences Research Council (EPSRC). It is the main UK government agency for funding research and training in engineering and the physical sciences working with UK universities. Overall, EPSRC invests around £740 million a year in a broad range of subjects - from mathematics to materials science, and from information technology to structural engineering.

The IDEAS Factory is an alternative concept for funding scientific thinking, used by EPSRC to stimulate highly innovative and more risk-accepting research activities. It tries to break down traditional barriers of a specific topic and build new relationships with different kind of stakeholders to create new ideas to solve a particular problem. The concept is based in the idea of intensive "sandpit workshops" that assemble the dynamic range of people and skills needed to find the solution to real problems from every angle. These workshops enable people to group and come up with different ideas in five days.

Ideas Factory concept is intensive "sandpit" workshops that assemble the dynamic range of individuals and skills needed to attract real world problems from every angle. Groups and ideas are formed, and are reviewed and potentially funded within five days. IDEAS Factory began life in 2004 with one aim - to provide a new dimension in problem solving. Subjects can be borne from a single

issue, with each sandpit seeking to create research teams with the diverse skills needed for success. The process is guided by the people for whom the chosen problem is an everyday reality "Sandpits" are residential interactive workshops over five days. It involves 20-30 participants: highly multidisciplinary mix of participants, some active researchers and others potential users of research outcomes, driving lateral thinking and radical approaches to address research challenges. "Sandpits" are led by a director with a group of stakeholders and subject experts working as mentors in support. This group is not eligible to receive research funding so act as impartial referees in the process. Sandpits are intensive discussion forums, where free thinking is encouraged to delve into the problems on the agenda and uncover innovative solutions.

When a "sandpit" is launched, there is a call document in the website and participants have a week to express in two pages their interest to participate. Their interest is sent to the director and a panel makes the selection with the advice of an occupational psychologist who identifies the right people to be engaged in the sandpit. Usually they receive around 350 applications for 25 to 35 participants, meaning 10% of less of the applicants can even participate. The panel usually takes one day to discuss and make the selection. Facilitators have a key role in the sandpits. They are employed and selected in order to put together people and make them interact, solve problems etc.

The quality of the research is guaranteed by the quality of the participants selected. Not all participants receive funding. Each group of participants presents the idea and all participants provide feedback and review other's ideas. Throughout the week, a peer review process is put in place and by Friday (last day) all ideas are ranked. Then the group has two months to make a more comprehensive proposal to be approved and validated. It has to be coherent with the idea presented in the "sandpit" and no major changes should be there. The director checks that there are no major changes. After the sandpit, 3 or 4 projects are selected to be funded. However, participants that have not been selected take home also the good network and all knowledge acquired in the topic.

Implications for scholars

The criteria for the selection of participants are the following:

- The potential to contribute to research at the interface between disciplines;
- The ability to work in a team;
- The ability to explain research to non-experts;
- The ability to develop new and highly original research ideas.

Participants are foreseen to have communication skills in order to be able to share their ideas and projects. They are expected to be good team workers, open-minded to listen to each other's perspectives and with a clear will to interact with others. They have to proof also to be creative.

> *"Attending the IDEAS Factory was one of the most significant career influencing events I've attended. It has enabled me to work with excellent researchers in new and interesting areas as well as helping me to develop my research and project leadership skills, and extend my network of colleagues across disciplines and universities." - Emma Soane, Kingston Business School"*[54]

The scholars participating in the "sandpits" develop new thinking in the subject, and are offered new networks and linkages with relevant people in the field and also strategic relationships with industry. There are usually researchers with a recognized career, but also PhD students and other type of stakeholders who provide valuable knowledge to the topic of the sandpit.

Stakeholders often include industry representatives, government officials, charities, lobby groups or

[54] Source: http://www.epsrc.ac.uk/newsevents/pubs/welcome-to-the-ideas-factory-home-of-innovation-since-2004/

citizens' groups. Their input helps other participants and researchers to better understand the issue and shape potential new ideas. This can include challenging presentations on the current state of play and can lead to future involvement with research groups.

Some of the disadvantages that have been highlighted in terms of success are the large number of applicants that apply for a sandpit and the low number of actual candidates that will participate in the workshop. A way to manage this potential "frustration" of rejected candidates is the possibility that the organization gives to those people to join the network of participants at a later stage. There is also later a workshop to share the outputs of the sandpit. This is an open workshop for the rest of participants.

Implications for institutions

In the sandpits organized, the role of other stakeholders different from the research community is very important. Organizations behind all these participants (researchers or other type) have to commit to the sandpit, as their staff will spent considerable time: in the sandpit (one week), but also later in case their idea is selected to receive funding. Sandpits should not be seen as a quick route compared to other funding mechanisms for research. This is something that needs to be managed by both the organizations and participants themselves.

Concerning the organization, it takes around 9 months up to a year to organize a sandpit by IDEAS Factory. It supposes a lot of planning, common effort and many people engaged in the organization.

The feedback from the participants is periodically gathered and reviewed. On the other hand, there is a formal evaluation in process about the mechanism. The evaluation will be available before spring 2015.

In order to scale up this alternative mechanism of funding, the Engineering and Physical Sciences Research Council (EPSRC) has organized joint sandpits with NASA, other US organizations, but also big partners in industry (Procter & Gamble). They have interacted with industry and sometimes they have organized a sandpit on behalf of a corporation.

Lessons learnt

Sandpits are great mechanisms but require a lot of planning. Not all topics are suitable for this type of mechanism. It enables free thinking and the emergence of new ideas. It requires the adequate people to be engaged and also very good facilitators, who are key for the success of the mechanism. Those facilitators are used to work with researchers and the academic community in those types of fruitful discussions.

3 ANALYSIS OF THE IMPLICATIONS

In this section we provide a higher-level analysis of the results of the literature review and the mapping and the case studies, in order to identify the implications for researchers, research organisations and governments.

3.1 Implications for researchers and research institutions

Alternative funding mechanisms seem to offer opportunities and risks. The literature review pointed to a set of hypothesis:

- The new research-funding mechanisms have consequences in the knowledge production of scientists; for instance, they privilege more applied science versus basic science and more experimental research versus theoretical research. It is also more focused on later stages research (more near to commercialization). It also requests more short-term research instead of long-term research.
- Furthermore, these new research-funding mechanisms have also implications to the skills required to scientists: they request communication and sales skills more common to entrepreneurs nowadays, in order to sell their research project to the "crowd" or to "private parties". These new emerging mechanisms are supposing some changes in the way research results and other research outputs are communicated, for instance, as compared with traditional scientists' exclusive focus on publication. Researchers acquire communication skills or ask for some support when trying to post the information about their research in a crowdfunding platform, or look for some mentorship when trying to sell their research to private donors.
- Other possible implications to be explored are the perceived quality of the research results by research community (increased or decreased compared to the traditional methods of funding) and whether these new mechanisms favour more risky and innovative research.

These hypotheses are further discussed in light of the results of the study below.

3.1.1 More diversity of funding can enable more diverse research

Researchers and research organisation increasingly have to live in a context of multiple funding resources. For researchers, this potentially leads to greater opportunities to pursue original research endeavours without having to "fit into" the priorities of the funders, hence leading to greater scientific freedom, as the I Lowe You case shows. At the same time, established scientists can less and less rely on a stable stream of funding, as funding mechanisms increasingly tend to vary over time. All scientists will have to further develop their fund-raising skills in order to convince a wide variety of funders: wealthy individuals, ordinary citizens (often reached through mass media or social media), government agencies and fellow scientists.

Young scientists, amateurs, and those active in niche disciplines and with low-capital investment research will most likely be the main winners from this plurality of mechanisms: no project will be "too small" to be funded.

Established research players, whose competitive advantage lies more in the knowledge of the traditional funding mechanisms themselves rather than in the topics of the research, may tend to lose more in this increasingly "liquid" landscape.

Fundraising activity will, in any case, take more time in the future, but this time will be more related to the presentation of the ideas than on the bureaucratic requirements.

However, there are risks as well as opportunities. Government funding has legitimacy, both in the research priorities and in the selection of research proposals, which private funding does not have. Researchers will have to deal with, and meet the needs of, individual funders that might neither be wise nor ethical in assigning the funding. There is also a risk that researchers could increasingly be expected to work "for free", as in inducement prizes where the cash flow of the pre finance is unclear. This can ultimately lead to a worsening of the economic conditions of researchers and a system where research is affordable only for wealthy individuals.

Research organisations will have to increasingly deal with a plurality of funders and be able to engage with different mechanisms. This does not necessarily mean that organisations should build their own mechanisms and platforms, but there should be an organisational culture (and skills) that enables dealing with different existing mechanisms.

3.1.2 More importance for applied research and some disciplines

The initial analysis of mechanisms suggests that these mechanisms tend to favour applied research and disciplines with high social relevance, such as health. Basic research and research with less direct impact on people's lives might be less adequately supported through alternative funding mechanisms.

In the long run, this might imply, if no countervailing measures are taken, an increased "funding divide" between basic and applied research.

Research organisations will have to take this imbalance into account in the management of human resources and budget.

3.1.3 Communication to become a basic skill for all scientists

New fundraising opportunities require greater communication skills for scientists and research organisations. The effort in communication is systematically highlighted by all interviewees as highly important and much more time-consuming than expected. Scientists have to invest more time in communication, and have to become better in explaining their research to a variety of funders, with different levels of skills and knowledge.

This effort in communication is not finalized only to raise money, but generates important positive spillovers. Funding is not just a transaction; it is the establishment of a relation. Scientists will have stronger links with citizens and other stakeholders, and hence will better understand their needs and problems. When dealing with specific health problems, for instance, fundraising will also become a community-building activity that is likely to generate rich exchanges of information between researchers and patients that will advance the research itself, as in the case of "I Lowe You". At the societal level, fundraising also becomes an awareness raising activity about scientific research, as in the case of "Team Puli". Lastly, discussing funding becomes also an opportunity to create networks of collaboration among scientists with similar research interests, as well as other stakeholders, as in the case of the "Sandpit" initiative. In other words, alternative funding mechanisms seem to support one long-standing goal of the introduction of competitive funding: to provide opportunities in terms of greater systemic interactions with other actors in the ecosystem, and in particular between researchers and society.

In summary, the greater effort in communication is likely to be not only a burden that deviates from "pure" research activities, but also a benefit in terms of knowledge exchanges.

Research organisation should recognize this need, provide scientist with adequate skills and possibly with support services to maximize the communication impact of the research projects.

3.2 Implications for policy makers

The analysis above allows us to highlight some conclusions relevant for EU policy priorities. In most cases, these are general implications valid for any government; in some cases, they are directly related to specific challenges of EU policies.

3.2.1 Alternative funding mechanisms are here to stay

The first consideration is that alternative funding is not a hype related to web 2.0, but a reality. The number of mechanisms identified makes it clear that, while fragmented, it is more than just an emerging trend. At the same time, the multiplicity of small scale platforms suggests the possibility of further consolidation in a more limited number of larger platforms, but it could also be that in the future we will see a more fragmented landscape with "one mechanism for every institution".

Moreover, alternative funding matters because it is deeply connected to long term trends internal to science. In particular, the emergence of "Mode 2" science identified the same trends that underpin alternative funding: the emergence of a plurality of funders, beyond government, that fund ad-hoc groups of scientists and not scientists around problems that are socially relevant. In other words, one could say that the trends identified by Baber et al. (1995) have grown to their consequences, and are likely to be further developed in the future. They are part of a long term historical trend towards more "liquid" forms of organisations that is visible in the development of science – and probably of society in general. As such, they should be taken seriously by policy-makers.

3.2.2 Addressing some key challenges of traditional funding

Alternative funding addresses some of the key challenges of traditional institutional and competitive funding as described in section 1.1.

Two of the most critical areas of government activities, identification of the research priorities and selection of the projects to be funded, are directly disrupted by alternative funding. One of the key roles of government is to determine which research areas to fund, and which projects deserve to be funded. Clearly, government typically do not make such decisions autonomously, but by involving the research community. Still, it is the government who typically mediates between different interests and decides who to fund. This role can be bypassed by alternative mechanisms. No longer is the government the only actor in charge of identifying the funding priorities by mediating between scientific curiosity, economic competitiveness and societal needs. In a context where wealthy and "normal" citizens can directly decide which project to fund with their money, they can directly take the decision to fund what matters to them. Furthermore, no longer are research priorities and approaches prescribed "ex ante", but increasingly decisions tend to be left "ex-post", once the project proposal is made (as in crowdfunding) or results are achieved (as in inducement prizes). This, again, reflects a broad trend, as summarized by Shirky (2009) in the expression "publish, then filter": in a complex world, it is more effective to delay the filtering as much as possible and make judgments based on results, rather than assumptions. Better than pre-selecting what social issues deserve to be targeted, let citizens decide directly which research to support, based on the proposals published on a crowdfunding platform. Thus, rather than deciding ex-ante which research projects deserve funding, award it to those that achieve the expected results.

Clearly, this questions the role of government as "gatekeeper" of deciding what is beneficial to society and what needs to be funded. Taken to its extremes, it could go as far as undermining the rationale for public funding; however, our research shows that alternative funding is complementary to existing methods, rather than a substitute.

Alternative funding seem an effective way to involve top researchers and innovators, as shown by both the "I Lowe You" and Puli Team examples, by overcoming some of the key challenges of traditional funding. On the other hand, it also seems suitable for involving early-career researchers to acquainting them with such emerging methods, as shown in the case of Fondazione Fondo Talenti e Ricerche. The simplicity of rules and the possibility to focus on the problem to be solved, are working effectively to reach those innovators who are typically reluctant to be involved in complex government procedures. Bureaucratic load remains very reduced across all cases.

Users, clients and citizens are "naturally" more involved, as in cases such as crowdfunding, they are the ones funding the research. The need to reach out to potential funders implies a stronger communication and design effort around users and clients.

3.2.3 Increased need for government leadership and vision

The literature review, the mapping and the case studies demonstrate that alternative funding mechanisms are important, but do not function as a substitute of traditional funding.

Firstly, they are typically limited in budget and would not be able to be sustainable in the absence of traditional funding. Crowdfunding, philanthropy, inducement prizes and open methods are effective because they act in a context dominated by traditional funding, and add value to it. The projects found on European crowdfunding platforms are only rarely targeting amounts above €50.000. Because of the intense communication efforts required, they are difficult to scale up and there is a risk of "prize inflation".

Secondly, alternative funding is biased towards "real world problem" and applied research, specifically in some areas such as health, and tends to favour researchers more able to communicate. Alternative funding mechanisms are not balanced in their discipline coverage, and much valuable research would not be suitable for it. Most importantly, the funders are not accountable to any organisation, and it is easy to think of the dangers that leaving the development of science to unaccountable organisations and individuals could produce: rich individuals would be in a position to determine the development of science. As such, it would be unthinkable to use alternative funding as main funding instruments.

Finally, all cases analysed in the study report that different funding mechanisms were used in combination. For instance, the Puli Team in the inducement prize had to first deliver crowdfunding to pay the registration fee, used sponsors for software, leveraged volunteer work and used direct funding from the project leader. Notably, the funding of the prize itself was not the main incentive, but rather a catalyser. Alternative funding mechanisms are typically designed to achieve a leverage effect, by mobilizing additional effort towards private sponsors, crowdfunding, as well as traditional funding. This interaction of different funding mechanism not only helps raising more funding, but acts as a demonstration of the validity of the project, of the capability of the team to mobilize interest and deliver results. Achieving sponsorships and additional funding is a "sign" that the project is valid and makes it easy to gain further funding.

These reasons make us conclude that different funding mechanisms are effective for different needs, and that governments should design its funding with a strategic, holistic perspective that takes into full account the existence of different funding instruments. As the OECD (2011) puts it, it is important to assess "whether the portfolio of funding mechanisms in place responds to an underlying policy mix or is, instead, simply the sum of different tools. Funding tools can either reinforce one another in a healthy, competitive environment or be overlapping, highly fragmented, potentially inconsistent and result in increased red tape". It is highly inefficient to design an instrument without taking into account the risks of redundancy, and the opportunity of synergy. Governments should recognize that, as in many other domains, there is a plurality of players

working in research funding, each with its strength and weaknesses, and that public funding today is just one of the possible sources.

4 CONCLUSIONS

The present research project was exploratory in its scope and therefore more systematic and wider-scale research would be needed to provide robust evidence about the full implications of alternative funding. This study does, however, provide sufficient evidence that alternative funding mechanisms are an important factor to be taken into account and deserve increased policy attention. It is not just about identifying additional funding streams, but about the relationships that are generated and the implications for science and for society.

Therefore, based on the findings presented above, we recommend an initial set of ideas (not yet developed as policy recommendations) that could be implemented when designing research funding mechanisms:

- Learning lessons from other mechanisms, such as the introduction of more open and agile funding mechanism as part of the public funding package. The EC has already launched several inducement prizes and there is clear potential for experimentation of other mechanisms, such as the Sandpit;
- Designing measures that ensure synergies between different mechanisms, for instance recognizing the projects who obtain crowdfunding with additional funding, or designing its research priorities as complementary to existing alternative funding, or sharing information on the "ratings" of different projects, facilitating the access to alternative funding for projects that were rated highly, but could not access public funding for budget limitations;
- Openly collaborating and ensuring that the combination of all mechanisms delivers the best results for the society as a whole. In other words, government should not fear being substituted by alternative funding mechanisms, but move its strategic role to a higher level: rather than deciding what needs to be funded, it should ensure that the combination of the decisions of the plurality of funders leads to the best results. This could include the introduction of favourable measures to ensure, for example, adequate tax exemptions for donations to crowdfunding platforms (which are currently not deductible).

At the same time, government could be in charge of ensuring that alternative funding respects some ethical criteria. As a minimum, governments should make sure that the most accurate information is available on the different funding mechanisms available, and make this available to researchers. Policy makers should ensure the availability of a complete map of funding mechanisms, as a service to researchers but also as a governance mechanism that ensures a systemic perspective in funding and the early identification of possible funding gaps.

Most importantly, it is an important trend that deserves more extensive data availability to support decisions. There is a need for more systematic monitoring of available funding, for in depth quantitative analysis of the initial implications advanced in this reports, and for in-depth discussion of possible policy measures, as well as pilot initiatives.

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