

A Pathway towards Multidimensional Academic Careers

A LERU Framework
for the Assessment of Researchers

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Executive summary

The assessment of research and researchers is currently a prominent subject in and outside the academic world. Unfortunately, the debate is often reduced to a discussion on the use of (some) bibliometric tools in individual assessments, without providing much of an alternative. With this paper, LERU wants to contribute to the discussion from a positive perspective, showing what a future for the assessment of researchers could possibly look like in the light of multidimensional academic careers.

For LERU universities, the assessment of researchers is at the heart of the scientific endeavor and provides institutions with a responsibility that is the flip side of academic freedom. This responsibility is taken seriously, as LERU universities increasingly pay attention to the environment in which research is executed, and in which young researchers are trained. This development is in line with the cultural transformation that is part of the Open Science movement and with several national initiatives on reward and recognition.

This paper started from an exchange of current practices and experimentation at LERU universities regarding the assessment of researchers in the context of hiring, promotion or evaluation, and develops a common framework that can inspire and support universities in this crucial responsibility. The underlying perspective is to reward and recognize a diversity of profiles and contributions, as they are all important for the overall success of the institution, be it in research, education, or in service to society.

Today, LERU universities already use a broad range of criteria to assess their researchers' performance. For research, this not only includes their scientific output and contributions to the progress in their field in a variety of forms, but also the recognition from their scientific community, their track record in competitive funding, their collaboration within and across disciplines and sectors, their strategic leadership in research and the advancement and enablement of junior researchers. For education, criteria include their engagement in high quality teaching, the development of learning tools and methods, their reflection on teaching practices and curriculum development, and their educational engagement outside university.

Most LERU universities also recognize the service their researchers deliver to society, often referred to as public engagement, outreach or impact. They also consider the duties and responsibilities their researchers assume in their institution or in larger collaborations, although this dimension is rarely formally elaborated or structured.

This multidimensional perspective focuses on the diversity of contributions that are expected from researchers in an academic environment. It aims to account for a diversity of profiles that today are needed in scientific work. However, it is insufficient to focus only on past performance, so two more perspectives are developed in the paper.

One is a developmental perspective, focusing on transversal dimensions such as leadership, innovation, and collaboration. To develop these dimensions over their careers, researchers need to develop themselves and their interpersonal skills. The importance of aspects such as leadership in an academic career is ever more recognized in the scientific community, but there is still much work to do to make these dimensions a structural and systematic part in the assessments of researchers.

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The other one is a contextual perspective, taking into account the particular context of the researcher who is under assessment. The term context can refer both to the professional circumstances in which the researcher works, as to his or her personal situation. Contextualization is controversial in assessment (not only in academia), but we argue that a contextual perspective is the only way to make research more inclusive.

After the elaboration of the three perspectives of assessment, the paper continues with several examples from LERU universities that are presently experimenting with new approaches to the assessment of their researchers.

The paper concludes with some key messages and with reflections on the fact that creating a new practice in assessing researchers is not an easy task. The experiments reported show that change is possible and effective, but that assessment processes remain complex and time consuming. Policy makers and funders should reflect on how they can provide the space for experimentation that universities need to improve their assessment of researchers.

1. Introduction

The assessment of research and researchers is currently a prominent subject in and outside the academic world. In itself, this attention illustrates the importance of research to modern society. However, many stakeholders¹ have voiced concerns over the way the assessment of researchers has evolved. The availability of bibliometric and other comparative data on research output has led to a growing substitution of sound judgment by bibliometric tools, which were not always designed for their present use. Their use in the assessment of individual researchers has been extensively criticized, including by those who have contributed to their design².

The debate on the use of Journal Impact Factors and h-indices has led to declarations such as DORA, the Leiden Manifesto and the Hong Kong manifesto, advocating a broader basis of research assessments and the avoidance of unwarranted use of bibliometric indices. The criticism has intensified in the context of Open Science, as traditional bibliometric indices are seen as a major obstacle in the implementation of Open Science principles. From an equality, diversity and inclusion perspective, the present assessment practices lead to bias and fail to account for or recognize the diversity of contributions that is needed in (academic) research today.

Although many stakeholders – including universities, research funding agencies, learned societies and journals – have endorsed these declarations³, (biblio)metrics are still widely used in individual research evaluations, their major advantage lying in the simplicity and efficiency in judgement they provide. Everyone who has served on an assessment panel knows how voluminous, complex and diverse application files can be and how difficult it is to compare them. It is tempting to use simple measures as a filter in order to capture such complex and diverse realities, and so much easier than focusing on what really counts. However, we must ask ourselves whether the term “efficiency” is appropriate in such an assessment context.

One issue with bibliometric indices is that they have become such a determining mark in the establishment of one's quality as a researcher, that they have become a token or currency in the competition for funding, positions and reputation. This process narrows down the focus of the academic researcher to those specific outputs that will help them to increase their indices, neglecting other aspects of their academic life, be it in research, education or service to society. It narrows down the concept of an academic career, that has always been much more multidimensional in its core than expressed by bibliometric instruments. It interferes with the recognition and rewarding of all the other important contributions that a researcher may deliver to aspects of academic life.

From this perspective, LERU wants to make a positive contribution to the discussion, one that goes beyond concerns regarding the lack of validity of bibliometric indicators, but focusing on their narrowness. For LERU, assessing the value of a researcher's work and his or her contribution to the development of the research domain is an essential part of academic life⁴. A scientific contribution can only be valued by confronting it with the criticism from peers from the community of inquirers. This is a fundamental element of the scientific project and an essential part of its emancipation from religious and worldly powers in the 17th and 18th centuries⁵.

The assessment of researchers is at the heart of the scientific endeavor⁶ and provides us with a responsibility that constitutes the flip side of academic freedom. As a research community, we cannot and should not externalize this duty to commercial publishers, such as Elsevier or Google. It is our responsibility as universities to engage in the assessment of researchers and to organize and support the processes by which scientific communities can deliver sound judgment. An assessment is essentially a judgment that can and must be supported by objective data, but it cannot be reduced to

1 Including the EU, the OECD and UNESCO.

2 See de Rijcke, e.a. (2016), de Rijcke, e.a. (2019), Hirsch (2020).

3 LERU itself and a number of LERU members have signed DORA (<https://www.leru.org/news/leadership-the-key-to-open-science-success>).

4 Assessment by colleague scientists is an emanation of the critical attitude and of the falsification processes in science that distinguish scientific knowledge from other knowledge systems (see the works of people like Karl Popper (1959), Thomas Kuhn (1962), Imre Lakatos (1970) and Helen Longino (2001)).

5 Toulmin (1990).

6 Our reference to science and the scientific endeavor covers all domains, including those of the Arts, Social Sciences and Humanities.

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simple metrics. Quantitative measures can be useful in this process as a complement to a broad and sound qualitative approach. But the discussion is not between quantitative or qualitative. The present debate on the assessment of researchers is an opportunity for the scientific community to renew its commitment to this essential academic process⁷.

This paper is an expression of LERU's dedication to this debate. As LERU universities have a strong focus on research, the assessment of researchers is at the heart of our operation. This is not a theoretical discussion. As we pay increasing attention to the environment in which researchers do their jobs, the indirect impact of assessment principles and practices does make a difference. We want to create a healthy work environment that stimulates our researchers to use their talents to contribute to the growth of knowledge in their field and to the education of next generations. We fear that a strong focus on number and reputation of publications can lead to a highly competitive, long-hours research culture, where bullying goes unnoticed and researcher wellbeing does not receive attention. In order for research to be successful and attractive to top candidates, and in order to implement Open Science values such as transparency and fairness, we believe universities must invest in a positive research culture that stimulates a diversity of researcher profiles and recognizes a diversity of contributions. There is no choice between excellence or diversity; on the contrary, we need a diversity of contributions to achieve the excellence we strive for. An environment in which a limited number of top researchers are performing at the expense of a large group of early-career researchers will not contribute to a sustainable advancement of knowledge. So, not only the contribution to knowledge, but also the contribution to a sustainable research culture must be part of the assessment process. These contributions must be recognized and rewarded.

In an academic context a sustainable research culture must also include the dimension of education. The interaction between researching and teaching is considered to be an essential element of an academic environment and an important driver of progress. However, this interaction is completely lost in the strife for high bibliometric scores. At LERU we do believe that it is impossible to assess an academic researcher without taking into account their engagement and contribution to teaching.

The goal of this paper is to develop and present a common framework for the way LERU universities assess researchers in a context of hiring, promotion or evaluation. This framework is based on an exchange of current practices and experimentation within LERU universities⁸. It is not a fully developed scenario, to be adopted by every LERU university, but it provides common ground and inspiration to each university to design its own assessment practices. As the duties and responsibilities of researchers in an academic environment exceed doing research, this framework on assessment of researchers will be much broader and include also education, service to society and leadership. This paper complements other recent papers from LERU on inclusion, scientific integrity, societal impact and on the implementation of Open Science⁹.

This LERU framework may also be relevant for assessments in a context of funding processes, even if this is not the focus of this paper. Aspects of research funding policy that do not refer to the assessment of the researcher looking for funding will not be treated in this paper. In a similar manner, research evaluations protocols (such as SEP in the Netherlands and REF in the UK) are not included in the framework, as they do not apply to assessments of individual researchers. This paper will not discuss developments on research assessment by funding agencies or national research (quality) bodies, although these developments are of course relevant in the debate.

7 The debate should be conducted in the scientific communities, not only by governments, funders or institutional policy groups.

8 We received information on their assessment practices from University of Amsterdam, Utrecht University, Universiteit Leiden, KU Leuven, University of Geneva, University of Helsinki, University of Freiburg, University of Cambridge, University College London, University of Copenhagen, Lund University, University of Zurich and Université Paris-Saclay. All LERU members contributed to the discussion or provided feedback on earlier versions of the paper.

9 The relevant LERU papers are listed at the end of the paper.

2. Towards a LERU framework for assessment of researchers

The performance of academic researchers is assessed on different occasions across their careers. For example, they are evaluated when they apply for an academic position, for promotion or tenure, or for continuation on a temporary contract. Several European countries have developed a system of regular evaluations for tenured academics at universities. In all cases an assessment implies a judgement on the performance, the development and the potential of the researcher. It may also imply judgement on his or her plans and aspirations. Assessments may be competitive (e.g. in hiring or when there is a limited number of promotions available) where the performance and potential of several researchers are compared, or non-competitive (e.g. in the case of evaluations) where the performance and potential of the assessed researcher are compared to a performance standard.

As the result of the assessment is (or is not) a positive outcome for the researchers involved, assessments provide unique opportunities to recognize the individual contribution of the researchers and to reward them. Assessments offer a direct instrument to universities to recognize the choices and efforts made by their researchers, the quality of their work and the talents they develop. Whether we intend it or not, assessments are instruments of reward. And because of the financial constraints that universities experience, these rewards are scarce. It is our duty as universities to deal with this scarcity in a conscious and conscientious way.

Traditionally, career assessments have often relied heavily on publication output. Given the massification of science, metrics are a useful tool to compare candidates or to relate a colleague's performance to an implicit or explicit norm. There is a risk, however, that these tools dominate the evaluation, reducing the scope of the assessment, with a possibility of further reinforcement by a halo effect. The impression of accuracy (numbers with decimal places) and objectivity (provided by an independent source) may further strengthen their dominance over other, less quantified, but equally important criteria, and may blind us to effects of bias.

Such a narrow scope can and will lead to bias in favor of

some researcher profiles and to a lack of recognition for other contributions. It can lead to frustration for candidates who have a different profile or who made different choices in their careers. They may feel misjudged and wronged, because their strengths did not get the same weight in the assessment than the publication ratio.

But the problem of narrowing down assessment is not limited to inflicting injustice. Universities are complex organizations where academic researchers—especially senior ones—assume broad roles, which are much more varied than publishing. It is in the interest of all stakeholders that evaluations reflect the broadness and diversity of expectations that universities, colleagues, students and early-career researchers have from these roles. This becomes even more relevant in a context of implementing Open Science, with its emphasis on open data, connection with society and integrity.

Although bibliometric data have played and still play an important role, LERU universities have always adopted a multidimensional perspective, where different dimensions of research performance and a variety of duties and responsibilities are taken into account for assessment.

In this context they have developed sets of explicit assessment criteria, which some universities have developed further into complete career frameworks. Such frameworks may be very elaborate, including different levels of performance and detailed examples of performance indicators, while other frameworks are more descriptive and broadly defined, allowing for differences between scientific domains. These general criteria are then further elaborated or specified by faculties and departments.

Such career frameworks are used for several purposes, not only for hiring and promotion processes. They also offer a clear perspective to young researchers who aspire to an academic career and provide opportunities for mentoring junior professors. They form the basis for conducting (regular) development interviews with academic staff or conducting a talent review in a research department (also known as a

“fleet review”). An assessment framework is at the heart of all human resources processes involving researchers and contributes to the research culture in the university.

Although the specific elaboration of their career frameworks may be very different, LERU universities share a strategic perspective on rewarding and recognizing researchers' performance. Several LERU universities are presently in the process of adapting their career frameworks, acknowledging the importance of making criteria behind assessments more explicit and examining whether they need to enlarge the range of criteria in the light of the developments in scientific practice. Overall, the goals for (re)designing recruitment, promotion and evaluation policies include:

- to increase the recognition for education, restoring the balance between teaching and research
- to strengthen academic leadership and appreciate good management practices
- to increase the focus on impact on society and service to society
- to move from a traditional individual approach to a contribution-to-the-team approach
- to endorse Open Science practices
- to stimulate equality and inclusiveness.

The underlying perspective is to reward and recognize a diversity of profiles and contributions, as they are all important for the overall success of the institution. This also means that broad assessment frameworks are not meant as a list of requirements that all need to be checked in order to qualify for a position at a LERU university, but they should help in capturing the variety of possible contributions that researchers make.

The quintessential broadness of career frameworks is reflected in three perspectives that form the basis of an overall LERU framework for the assessment of researchers. This paper elaborates these perspectives based on practices and plans in LERU universities. We distinguish:

- (1) a multidimensional perspective, focusing on the diversity of contributions that is expected from academics today;
- (2) a developmental perspective, focusing on personal growth and development of true leadership; and
- (3) a contextual perspective, taking into account the particular context of the researcher who is under assessment.

These three perspectives are now elaborated in the following part of the paper.

3. A multidimensional perspective

The job of an academic researcher has always been multidimensional: developing the knowledge in one's field, passing on this knowledge and the research methods associated with it to the next generation through teaching and supervision, developing young people into academic professionals, providing direct service to society, such as organizing patient care in a university hospital, informing the general public about research results, sharing technology with industry or advising policy makers. The examples in this paragraph refer to the three basic duties of a university: research, teaching and service¹⁰.

All three duties have changed in the past decades, increasing the need for a multidimensional assessment. First, science itself has changed and has become more and more a team effort. Technology and research resources have multiplied rapidly. New fields and interactions between fields are proliferating. Networks and collaborations become even more important. There is a growing dependency on (software) engineering and automation, and the use of big data, leading to new contributing profiles and expertise. No single researcher can master all aspects of modern research, so collaboration is essential. The old, romantic ideal of the individual scientist as a brilliant loner is outdated¹¹. In a similar way, education has changed, with team teaching, more diverse teaching approaches such as flipped classrooms aiming to enhance the active participation of students, digitalization and a stronger emphasis on life-long learning.

Second, society's expectations of science have become greater than ever. The examples of the Corona pandemic and the challenge of climate change illustrate that society expects answers to its global challenges in the short term. As financial investment in scientific research is larger than ever, in return society expects the research community to open up and collaborate in order to address these impactful and pressing societal challenges. This demand has evolved beyond the traditional distinction between fundamental and applied science into the concept of Open Science.

Society demands that its universities become open partners who commit themselves to collaboration with industry and society. This impacts the research environment, creating a broader ecosystem and new roles and requires new skills for researchers. These roles and contributions must be recognized and valued¹².

Open Science captures several of these developments in its focus on open publication and open data, collaboration with societal stakeholders, including citizen science, and in research integrity.

3.1. The research dimension

Being an academic researcher entails many more duties, services and responsibilities than publishing in journals of high reputation. Peer reviewed publications are an essential indicator of one's recognition as a researcher by the research community. They are a proxy indicator of many research activities and qualities, such as creativity in designing a study and rigor in its execution and analysis, ability to secure resources, management of all aspects of the research process, embeddedness in existing research and in the work of other researchers, and so on¹³. From this perspective, it makes sense to use publication data when comparing the research output between researchers. However, the relevance of these indicators may be limited once a certain threshold has been exceeded, as it does not capture other important contributions that are also expected of researchers.

Table A gives an overview of criteria LERU universities use today to assess research performance. Examples are provided from existing career frameworks of different universities. This overview shows that even within the research dimension, LERU universities use a variety of criteria and have moved beyond the traditional metrics before this became a public debate.

10 In many cases these three basic duties are translated into four dimensions for assessment: research, education, service to society and service to the institution.

11 The evolutions described will affect different disciplines in their own manner, so in some fields individual and unfunded research will remain a possibility. However, team science is also well-rooted in the Arts, Social Sciences and Humanities.

12 This is why "training" and "reward and recognition" are key pillars in the implementation of Open Science.

13 The Contributor Role Taxonomy (CRediT) describes 14 different contributions researchers can make to scientific scholarly output (publications). This tool illustrates the complexity of getting research published and why publication data have been used as a proxy. <https://casrai.org/credit/>

Table A: Criteria for assessing research performance presently used at LERU universities

1. Contribution to the subject area through expertise, research output, scientific impact and influence	
<i>Examples</i>	<ul style="list-style-type: none"> • a leading international expertise in the subject area • significant influence on the subject area by recognized publications • a substantial portfolio of high-quality research outputs that are internationally recognized as world class • impact through high quality-research and/or citations • significant contribution to the advancement of knowledge in the field • the number of publications (in relation to the individual's career)
2. Recognition in the scientific community	
<i>Examples</i>	<ul style="list-style-type: none"> • participation in national and international scientific networks and conferences • invitations to present as key-note speaker or invited lecturer • leads major research conferences • prizes and honors for research • editing or reviewing for major academic journals • elected to research-related leadership roles in the community • reputation and recognition by peers
3. Track record in funding	
<i>Examples</i>	<ul style="list-style-type: none"> • winning competitive funding • research projects and their funding • ability to acquire third-party funds
4. Collaborations and interdisciplinarity	
<i>Examples</i>	<ul style="list-style-type: none"> • develops cross-disciplinary research activities • leads collaborative research projects • maintains international research collaborations
5. Research strategy	
<i>Examples</i>	<ul style="list-style-type: none"> • articulated vision on subject area, also covering ties to adjacent areas • provide intellectual thought leadership • setting the international research agenda • development of research and funding strategies • developing strategies for societal impact • originality of research
6. Advancement and enablement of junior researchers	
<i>Examples</i>	<ul style="list-style-type: none"> • excellence through the performance of others • high research student completion rates • nurtures talent and demonstrates engagement with researcher training and development • demonstrates inclusive leadership and provides a positive working environment

A word of caution is needed here. The tables do not represent the full LERU framework that this paper develops. They represent an overview of *existing* frameworks, which are under constant review and which this paper aspires to inspire. Also, some items may seem repetitive as similar criteria have been differently worded in different universities.

The basic research criterion is to contribute to scientific advancement in one's research field (criterion 1). The number

of peer-reviewed publications is only one aspect of this contribution, and one that must be assessed in relation to the individual's career position, academic age and possible career breaks. This refers to the contextual perspective that we will develop later. It is clear that this criterion is highly vulnerable to metrics bias and it may not reflect the intellectual contribution to a field. As we will discuss later, the number of publications also depends on opportunity, which is on its turn related to research topic and scientific discipline.

Several LERU universities refer to the DORA principles in their instruction of assessment panels or provide other useful instructions on how to use metrics in a responsible way.

Another way of assessing the quality of a researcher's contribution to his or her field is to look for signs of recognition in the scientific community (criterion 2). An active engagement in the scientific community is an essential part of the researcher's job. It is through this engagement and interaction with the scientific community that science progresses. However, some examples provided in the career frameworks are more indicators of the visibility of the researcher in the community than of his or her contribution. Visibility may be dependent of personal strategies and choices, and is not always a good proxy for contribution. It is susceptible to bias (e.g. the old boys' network) and may disadvantage those who may not be able to travel easily. As in every organization, researchers may offer a lot of "service" work to the community without taking formal positions or receiving recognition, because it is not considered prestigious (e.g. reviewing for non-major academic journals).

The criterion of funding (criterion 3) is yet another measurable indicator of research quality. Universities assume that researchers who are very successful in acquiring competitive funding must be excellent researchers. Again, this needs contextualization, as the availability of funds can be very different according to the research subject. You do not want to be an expert in bacterial infections when there is a virus outbreak. But in the context of modern science, the ability to acquire research funds is an essential element of a (senior) researcher's job¹⁴. As with publications, it is a requirement, but it is not clear whether it is a good indicator of scientific quality beyond that. Funding may also be contaminated by an element of prestige, as some types of funding (e.g. such as ERC grants) are considered to indicate top quality and the originality of one's scientific work. However, this implication of quality may be just as much biased as it is with high impact factor journals, in this case leading to a Matthew effect in funding.

At present, collaborations and interdisciplinarity (criterion 4) are rarely mentioned in the career frameworks. Recognition is slowly building that moving beyond one's own discipline and setting up broader collaborations (e.g. with industry) is not

easy and requires initiative, talent and hard work. This should be valued in career assessments. In LERU universities this aspect of research contribution is becoming increasingly relevant and is part of assessment criteria reviews. Collaboration with citizens and industry is also growing into an essential element of European and national research policies, as exemplified by the KIC's of the European Institute of Innovation & Technology¹⁵ or by the Open Science agenda. Many LERU universities have strong technology transfer offices. Also, the importance of interdisciplinarity is increasingly recognized, not only because challenges (such as Corona) require inputs from different disciplines, but also because interdisciplinarity can be a driver of progress for each of the cooperating disciplines through cross-pollination on a methodological or a conceptual level¹⁶.

The fifth criterion, research strategy (criterion 5), is related to the previous one. LERU universities look for researchers who can do more than execute high quality research. They need researchers who can go beyond the individual research project, who can initiate, build and develop research programs. This is the stuff modern science is made of¹⁷. Research programs provide continuity in research and allow universities to build upon previous research efforts, accumulate an IP portfolio and institutionalize research networks and collaborations. Such "builders" or entrepreneurs are important assets for research universities such as the members of LERU as they make an above-average contribution to the advancement of their fields.

A final criterion refers to the supervision of early-career researchers (criterion 6). In some LERU universities this criterion is part of the teaching dimension, in others it is part of the leadership dimension. It exemplifies the importance of leadership over early-career researchers, and illustrates that today the output of the academic world is not only papers and patents, but also people¹⁸. We will discuss this criterion in the context of leadership as part of the developmental perspective.

From this overview it may be clear that the principles of Open Science are not yet systematically incorporated into the career frameworks of LERU universities. Although several LERU universities have elaborated policies¹⁹ on open publication, open data, societal impact and research integrity,

14 This does not mean that unfunded research, or basic undirected funding cannot continue to have an important role in the research ecosystem. Not all researchers focus on external funding. In some cases they feel that the time-cost in managing grants will outstrip the potential benefits. This is again field-specific.

15 <https://eit.europa.eu/>

16 See LERU paper *Interdisciplinarity and the 21st century research-intensive university* (2017).

17 See Lakatos & Musgrave (1970).

18 See LERU paper *Delivering talent: Careers of researchers inside and outside academia* (2018).

19 E.g. Sorbonne University: https://www.sorbonne-universite.fr/sites/default/files/media/2021-05/01_Valorisation%20science%20ouverte.pdf

at present these developments are insufficiently reflected in their career frameworks.

3.2. The education dimension

Beside research, universities also provide research-based education, and teaching duties constitute a basic component of the academic research job. It is precisely the nexus between research and teaching that is at the heart of the university as an academic institution²⁰. Table B gives an

overview of the criteria for education that are presently used by LERU universities.

The first criterion for assessing educational performance is the development and execution of high-quality research-based teaching (criterion 1). This may include different types of teaching and supervision duties and participation in feedback and grading processes. Universities have extensive teaching quality programs that deliver information on individual teachers. Consistent positive feedback scores from student surveys are one indicator of teaching

Table B: Criteria for assessing educational performance presently used at LERU universities

1. Engagement in high-quality teaching, including individual supervision and feedback/assessment of student performance	
<i>Examples</i>	<ul style="list-style-type: none"> • offers education excellence, provides high-quality teaching, teaches effectively, has extensive teaching experience • provides individual supervision of bachelor, master and doctoral theses • integrates research-based practice into course design and teaching • assesses teaching quality and student learning ('exam duty'), gives meaningful feedback to students • positive feedback scores from student surveys (and/or from peers) • teaching awards
2. Development of learning tools and methods	
<i>Examples</i>	<ul style="list-style-type: none"> • regularly adopts course design, teaching technology and assessment techniques • introduces innovative teaching methods • produces and develops learning materials • acquires funding for teaching innovation projects • publishes major textbooks or e-learning material • author of educational materials in the subject field with national or international reach
3. Reflection on teaching practices and curriculum development	
<i>Examples</i>	<ul style="list-style-type: none"> • active in professional development of own teaching skills • works collaboratively with students and colleagues to improve the quality of education in response to student feedback • regularly requests feedback from students, colleagues and others • mentors colleagues with the aim of developing their teaching practice • develops teaching staff through mentoring and supervision • contributes to curriculum mapping, planning, development and learning design • contributes to significant curriculum reform, a curriculum leader
4. Educational engagement outside the university	
<i>Examples</i>	<ul style="list-style-type: none"> • engagement with education policy and practice in a national context • curriculum reviewer for other universities • holding an educational leadership position within a professional body • engagement in lifelong learning programs

²⁰ See LERU paper *What are universities for?* (2008).

quality, teaching awards may be another. However, the reliance on student reviews is almost as much criticized as publication metrics, as they also show bias²¹ and should be complemented by quality assessment by peers or teaching specialists. While not visible in the table, universities do contextualize the teaching efforts of their researchers, e.g. by acknowledging the difference between teaching an introductory course to a large group of first-year students versus teaching a specialized subject in your field of research to a small group of master-level students.

Developing learning tools and methods (criterion 2) is also part of the teaching assignment and thus part of teaching assessment. Universities operate at the frontier of knowledge, and their education must reflect the advancement of research, both in terms of content and in terms of developing innovative teaching material and practices. The recent shift to online teaching is only one example of this evolution. This criterion also implies that teachers actively invest in the professional development of their own teaching skills.

A third criterion in the assessment of education at LERU universities is reflection on teaching practices and curriculum development (criterion 3). In their teaching role, researchers are expected to engage in broader processes oriented towards improving the quality of teaching. This includes interacting with student groups, contributing to quality processes in education and taking a role in curriculum development and planning. As the educational research literature has expanded beyond the capacity of individual teachers, there is also a need for comprehensive evidence syntheses. The Royal Society and The British Academy recommend that evidence syntheses should be properly recognized as academic output²².

These three criteria are not independent from one another. It is the combination of excellent teaching, developing teaching material and practices, and contributing to curriculum development and teaching quality processes that constitutes the educational role in an academic context. Some LERU universities ask their researchers to provide a “teaching portfolio” for their assessment, which covers all three aspects of the teaching role. This exercise is both descriptive and reflective, describing one’s teaching experience and reflecting on it. Researchers then receive feedback on this portfolio from peers, to stimulate them in further developing their educational role.

For a number of years now, several LERU universities have emphasized the inclusive aspects of teaching. Both in the teaching process itself and in the development of tools and curricula, more attention is given to the inclusiveness of our educational system, i.e. to its capacity to include students with atypical profiles, such as students from disadvantaged or minority groups, part-time students, or students in a later stage in their professional career.

This last remark brings us to the fourth criterion. Education does not stop at the doors of the university, so educational engagement outside the university (criterion 4) is also important. Unfortunately, this criterion is rarely mentioned, as university education efforts are primarily focused on young people pursuing their basic education. Researchers engaging in lifelong learning are often insufficiently recognized for their efforts. We expect that a stronger attention paid to inclusiveness will stimulate universities to widen the scope of their educational practices.

The supervision of early-career researchers was already mentioned as part of the research dimension, and will be discussed in the leadership section. In some LERU universities, it is classified in the education dimension.

3.3. Public engagement and outreach

Public engagement or service to society is a third major focus of universities. Universities tend to use their own terminology in this respect, although the terms “impact” and “outreach” have become more used in recent years. The idea behind this dimension is that universities not only serve their societal environments indirectly through research and education, but also through direct interaction and service.

Typical examples of public engagement in an academic context include patient care in the university hospital, industry collaboration and technology transfer activities, contribution to north-south development programs, activities of government advice and public policy, science communication and public impact through the media, and engagement in professional practice and professional bodies. All these examples are considered to be part of the fundamental mission of a university. This public engagement may exist at the individual researcher level, stemming from the researcher’s own

21 See e.g. Adams, e.a. (2021) and Boring (2017). See also LERU statement Concerns and recommendations on the use of student satisfaction in measuring teaching quality. <https://www.leru.org/publications/statement-concerns-and-recommendations-on-the-use-of-student-satisfaction-in-measuring-teaching-quality>

22 See LERU paper *Tomorrow’s Teachers Today: What Universities Can Do for the Teaching Profession* (2020), p. 8.

initiative or network, or may be embedded in partnerships at the institutional level, where the researcher plays a part in the collaboration between the university and other partners. In some countries this service to society is part of the legal mission of universities. Most LERU universities include such services in their criteria for assessment in one way or another.

The Open Science movement has increased the importance of public engagement and enlarged its scope to a more generalized concept of “impact”. Researchers are challenged to reflect on how their research could contribute to large and complex societal issues, such as providing a healthy environment, the energy transition, new materials for the future, migration issues, fighting poverty, etc. Citizen science is an illustration of this new concept of “impact” as it aims to break down the barriers between scientists (researchers) and the general public in a process of co-creation. Researchers are thus stimulated to collaborate in their research with stakeholders beyond their peers.

Although LERU universities are very active in this concept of “impact”²³, so far it does not directly show in their career frameworks. This may have to do with the difficulty defining impact or measuring it, except perhaps with (proxy) indicators such as the number of media appearances, patents filed or spin-offs created. The concept of impact may be very different in an applied research setting than for fundamental or so-called “blue sky” research. The increasingly frequent obligation to describe the potential impact of one’s research proposal may lead to the general notion that all research should have a direct practical application, which of course is not the case. Furthermore, attempts to measure societal impact by all kinds of “alt-metrics”²⁴ – despite their theoretical appeal – have so far proven to be rather unreliable and vulnerable to manipulation. There is also debate over whether impact can be attributed to an individual researcher, or if it should be measured on a collective (e.g. a university) level.

In more general terms the increasing attention to “impact” highlights the difference between output and outcomes. In assessing researchers, we must look beyond activities and outputs, and evaluate the outcomes of research and education, even if they are difficult to define and measure. Another problem is that impact may take time to manifest itself, so that achievements may only become visible after longer periods of time. This is why we focus in this paper on the notion of “contribution”.

3.4. Service to the institution

As most LERU universities are, to a large extent, run by professors themselves, taking on organizational duties is part of the senior researcher’s job. Such duties may be formal university positions, such as dean, department chair or chancellor, or may be more informal positions, such as the coordinator of a research institute or a teaching program.

Other duties may include all kinds of representational, administrative or project responsibilities in the institution. Universities need people to manage complex research collaborations, negotiate with funders and government representatives, fill commissions and panels, represent the university on boards, and so on. Such duties are increasingly entrusted to specialized staff (often former researchers), but a large proportion still needs to be taken up by senior researchers themselves.

The duties described require talent, time and skills. Some researchers are better in these roles and spend more time on them, than others. As some service to the institution is expected from every researcher, it is often not elaborated in the career frameworks. However, this risks to become “invisible work” that remains unvalued, as we will describe further. In any case it leads to a lack of recognition of the talent researchers may have for such responsibilities and the time they may devote to serving their university.

In this dimension we also want to focus on the contribution, not on the roles or memberships themselves. The assessment process needs to differentiate between genuine contributors and those who just “serve time” in roles and on committees because it looks nice on their résumé. Again, this requires collecting relevant information and producing sound judgements.

3.5. Other dimensions

In all LERU universities the career framework includes research, education and public engagement (in one way or another). Service to the institution is sometimes mentioned, or otherwise largely assumed.

There are other dimensions that can be found in some LERU universities, and these more unconventional dimensions are in most cases the result of recent reforms. On the one hand

23 See LERU paper *Productive interactions: Societal impact of academic research in the knowledge society* (2017).

24 <https://collections.plos.org/collection/altmetrics>

they reflect new criteria that researchers must measure up to as a consequence of how the scientific profession is evolving. On the other hand, they show that universities enlarge their assessment framework to dimensions reflecting the scientific process itself, instead of limiting themselves to the results produced.

The most important additional dimensions taken into account by LERU universities are leadership, collaboration and innovation. What they have in common is that they apply to all three missions of a university: research, education and service to society. In this sense, they are transversal dimensions, bridging the other dimensions and criteria. They focus on the researcher as an actor, rather than in his or her achievements. We will discuss these criteria later in the developmental perspective.

3.6. Discussion

One general observation we can make in exploring these career matrices from the LERU universities is that they all mark a shift from “output” to “contribution” in all its different forms. We believe this is a very important evolution, one that is especially relevant for the implementation of Open Science.

In the case of simple operations, performance can be easily defined in terms of activities or outputs, but this is not sufficient in complex environments such as universities. Reducing performance to first or senior authorship blinds us to the diversity of contributions researchers are making. This diversity exists in all the domains and criteria that we have discussed. If contributions are not duly reflected in the output criteria, they go unnoticed, and are thus undervalued. In the literature this is called “invisible work”²⁵. The distinction between visible and invisible work is socially constructed within an organization, both through daily events and signs (such as comments) as through choices in formal processes.

The criteria for assessment in a career framework are clear indicators of which contributions are valued within the university and which are rendered invisible. Some exclusions may come from an assumption that certain activities are “normal”, and thus “expected” from every researcher. An example is the contribution to peer review processes. Universities may assume that all senior researchers

participate in reviewing for journals, are members of panels for selecting research grants or are members of recruitment committees. However, this assumption is not verified. Some researchers may invest a lot of time in this service to the scientific community, while others are very keen to escape from such duties. By not including this type of contribution in the assessment framework, the real diversity of contributions remains unnoticed in the assessment process and the researchers who invest a lot of effort in such activity are not rewarded for that effort.

In a similar way we may assume that all senior researchers are involved in public outreach in one way or another. The reality, again, is that there is a wide range of involvement in such processes. As the Covid-19 pandemic has shown, public outreach has become an essential part of the research process. Not every researcher has the same talent for explaining complex findings to the general public or likes to talk to the media. It is important to acknowledge the contribution of researchers who strongly engage in public outreach, maybe at the expense of time spent writing publications or grant proposals.

Several other examples can be given. In general, universities have a number of contributions on their maps, for evident reasons. Criteria for evaluation or promotion often include industrial collaboration, technology transfer (patents and spinoffs), patient care in medical sciences, and participation in north-south development programs. In many cases, some duties in university management (such as serving as dean or chair) will be acknowledged and valued.

But other contributions remain unnoticed and cannot be deduced from output information. Some of these are more supportive in nature, others have a stronger entrepreneurial character. Examples include the organization of workshops or conferences, engagement in learned societies and national academies or in professional licensing bodies, assuming supporting roles in research such as quality control, software engineering or the development of protocols or innovative instrumentation, establishing networks and making them work (which requires a lot of time, effort and talent!), mentoring and guidance for the next generation of researchers, taking the lead in educational reform, developing and sharing innovative teaching material, creating bridges between disciplines, giving advice to policy makers, representing the

²⁵ See e.g. Braun (2017) and Cooper (2021).

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university in external bodies, demonstrating leadership in EDI (equality, diversity and inclusion) initiatives, etc.

We should not forget either all the small duties that have to be done every day in a large-scale research environment, and that may be very unevenly distributed. Today research is team science, often performed in networks that may have a very large scale²⁶. But even in a small research team, the outcomes are seldom the work of one individual researcher. Small contributions may have a profound impact on the success of the team, such as mediating an inter-personal conflict, persuading a promising researcher not to accept an offer from another lab, paying some extra attention to a foreign researcher who is struggling to adapt to the local culture, or helping a colleague out with a technical issue. By focusing on the variety of contributions, universities can acknowledge the growing collective nature of research projects, even when the assessment itself is only focusing on one person.

Having discussed different dimensions of assessment and an array of possible aspects to be taken into account, we also need to add a word of caution. Broadening the perspective of assessment poses a challenge, both for the assessors and for the researcher who is assessed.

When universities expand their career frameworks in order to recognize the diversity of contributions, they risk giving an implicit message that you have to excel in every possible aspect of the job. Especially in a competitive assessment environment, it may induce the idea that you can never do enough and add to the already high pressure in an academic environment, especially for junior, non-established researchers. Broad criteria are meant to recognize a variety of profiles, not to push researchers even further into stress. Universities must make clear to their researchers and candidates for positions that they need not check all the boxes of the comprehensive CV, but that the overall level of contribution is what counts²⁷.

To this end some LERU universities put a caution on their elaborate frameworks explaining that these frameworks are not “checklists” and that the given examples should not be taken literally as requirements.

So far, however, researchers see themselves faced with an ever expanding universe of expectations. Open Science is one driver of this expansion, as are general research policies from EU and national governments, who focus increasingly on the research process itself and expect a specific return from their research funding. A diversity of criteria may lead to dilemmas. The expectation that time and effort will be spent in creating a positive research culture – which is a long-term endeavor – conflicts with the expectation that a high productivity in publication output is maintained in the short term. Researchers are expected to engage in collaboration with industry partners, but at the same time should open up their data in the context of Open Science, potentially exposing themselves to intellectual property issues. And how can researchers combine the growing focus on team science and collaborations, when career progress systems largely remain individual and competitive?

Moreover, as the relative weights of these proliferating criteria are unclear, which is necessary to allow a more diverse recognition of contributions, the impression may arise that there is no consistency in judgement, prompting allegations of unfairness and favoritism. We know from research and experience that these uncertainties offer favorable conditions for bias in judgement.

The assessors, meanwhile, face the challenge of judging many criteria, often with no more than self-reports and qualitative data for some criteria, and must compare a much more diverse array of profiles. Metrics provided an easy standard for benchmarking or for shortlisting, even across fields. Those who emphasize that the assessment should be objective ask for a clear and predetermined relative weight for each criterion, so that any “ad hoc” is avoided. However, this would automatically generate a hierarchy between criteria while the whole recognition movement started by just questioning such an absolute hierarchy. It seems difficult to account for a diversity of profiles and contributions with a fixed weight matrix for all criteria.

One solution that has been applied at LERU universities is that all (general) criteria must be scored or discussed for each candidate, in order to make comparison of diverse

26 Examples are the KIC's from the European Institute of Technology, where consortia can count up to 400 partners, or larger research platforms, such as CERN.

27 An interesting example is the CV template that was recently developed by the Finnish National Board on Research Integrity. It is very comprehensive, covering every aspect of performance. However, such a format may lead to CV's with dozens of pages. <https://tenk.fi/en/advice-and-materials/template-researchers-curriculum-vitae>.

profiles more systematic. Another solution is that universities try to make a distinction between minimal requirements and extras that may receive recognition above the normal standard performance. Yet another approach is that the researchers themselves “choose” the set of criteria that they deem most relevant, by asking them which of their outputs have value and matter to them personally, and why. Several LERU universities, for example, ask assessment candidates to highlight their five most important contributions or achievements. Another solution that is used in the context of a Tenure Track assignment, is that evaluation criteria are individually specified and agreed upon at the beginning of the Tenure Track period, so that the young researchers know how they will be assessed at the end of the Track.

4. A developmental perspective

In the previous section we demonstrated how LERU universities use a broad range of dimensions to assess their researchers' performance, providing room for different profiles and specializations. This is already a big step beyond traditional publication metrics, but in this section we will explain that broadening the range of assessment criteria is not enough to make the full transition from a performance approach to a new approach focusing on contribution. The criteria described in the previous section still put an almost exclusive emphasis on achievements, or "past performance". A researcher's achievements are certainly relevant in selection, promotion or evaluation processes, but we should not limit ourselves to these. In this section we will discuss the importance of the transversal dimensions mentioned earlier – leadership, collaboration, innovation – from a perspective that focuses on development and potential, rather than on past performance.

An academic career is characterized by a never-ending development of skills and roles, matching growing expectations from the university regarding output and contribution. From the starting researcher in phase R1²⁸ to the leading researcher in phase R4, growing role expectations and role demands require a corresponding personal development of the researcher. No one expects a PhD student to be capable of leading a large research collaboration or serving as a dean. But on average, we do expect that a researcher in R4 has the competencies to do so. Researchers increase the range of their outputs and contributions and take up new responsibilities gradually as their careers develop. It starts with small responsibilities in the research lab, representing the team on a department board, taking a leading role in a committee, eventually expanding to formal managerial roles inside and outside the institution.

The competencies needed to take on these responsibilities, however, do not come automatically. They require personal and interpersonal development of the researcher, as he or she becomes more and more independent, and gains more

and more experience in facing the interpersonal challenges of a complex research environment. Today, taking up responsibilities in a research team or collaboration requires the skills to create and maintain a positive and stimulating research culture, to collaborate over traditional boundaries with other disciplines or sectors, to turn diversity into an asset and provide every member of the team or collaboration with the opportunity to give his or her best.

As a university, we may offer training and mentoring as they are useful tools to support such personal development. Training and development have become increasingly important in higher education policy. While some talent is required, of course, we will not succeed in facing the challenges of large-scale research collaboration or the issue of toxic research cultures if we do not pay more attention to this developmental perspective in our assessment programs. From the start of their careers, in R1, we need to stimulate young researchers to explore their interpersonal talents and skills and pay attention to their personal development. This development never stops, or at least it should not. Nor should our attention to this perspective stop when a researcher achieves tenure.

4.1. Leadership in academia

The personal development perspective can already be found in the present career frameworks of LERU universities in the leadership dimension. This leadership is important for the university, for the quality of teaching and research, and for the students and employees supervised by senior researchers. Table C gives an overview of criteria for assessing leadership presently used at LERU universities.

As we can see in table C, the term "leadership" is used to describe several aspects of a senior researcher's role. Two aspects, developing people (criterion 3) and taking a leading role in a complex environment (criterion 1), are the most cited, but the other two are equally important.

28 The terms R1 and R4 refer to the European framework for research careers (see <https://era.gv.at/era/human-resources-mobility/towards-a-european-framework-for-research-careers/>). In this paper, the term senior researcher generally refers to phase R3 and R4 in this framework.

Table C: Criteria for assessing leadership presently used at LERU universities

Leadership dimensions
1. Senior academic responsibilities and leadership in partnerships, networks, institutional collaborations, scientific bodies, etc
2. Vision of future research direction, impact on the international research agenda, exploring and developing new ventures
3. Responsibility for people (students, researchers) and their development, equal treatment, diversity and an inspiring and stimulating working environment (local research culture)
4. Role model for university values (collegiality, mutual respect, research integrity)

The first form of leadership refers to taking a leading role in a complex environment (criterion 1). As mentioned already, universities have developed into complex ecosystems and research is increasingly practiced in large collaborations and consortia. These have to be initiated and managed, both in terms of collaboration and resource allocation and in the development of their research strategies. Making things happen in such a non-hierarchical environment requires leadership and skill. Not all researchers are successful in these aspects of their careers, and this is not a problem. But those who do develop this type of leadership skills and prove to be “builders” of the future, should be acknowledged in the assessment process.

The second item in table C refers to the fact that managerial skills alone are not sufficient to have impact on the research environment. You also need people with original ideas, who have the ability to think independently and out-of-the-box (criterion 2). To a certain extent one expects this from every researcher and we train our students for independent thought. However, researchers differ in the level of their innovative thinking, and in their ability to design new research strategies and turn them into collaborations and ventures. This ability must be stimulated, developed and recognized, together with the other aspects of leadership.

The third form of leadership is oriented towards responsibility for people (criterion 3): (senior) researchers have a responsibility towards their students, their early-career researchers, their collaborators, their colleagues. This responsibility originates from the roles they execute during their career: as lecturer towards students, as promotor/supervisor to starting researchers, as mentor towards new colleagues, as head of a research unit towards their team of collaborators, as department chair towards the larger

department, and so on. One of the central aspects of leadership is developing other people. In a research context this aspect is even more important, given the delicate power relationship between a PhD student or postdoc and his or her PI or supervisor. The assessment needs to pay attention to the leadership track record of the researcher assessed. Is (s)he able to attract people with strong profiles and develop them further? How is (s)he evaluated as a supervisor by his/her students and postdocs? Is (s)he capable of developing leadership in the researchers (s)he is supervising? One original idea that is spreading quickly is to check what positions former students and postdocs have acquired since leaving their PI. Strong leaders attract people with strong profiles and make them even stronger. True leaders are those who develop leadership in the next generation. The idea is that leadership can be inferred from the career progress of former students or postdocs. Another way of assessing leadership is to obtain recommendation letters or other forms of feedback from current and former group members – obviously without the researcher assessed seeing them. There is a significant difference between a senior researcher with a successful personal research output and a senior researcher who fosters researchers that have a promising career outlook and become leaders themselves.

Finally, researchers need to become role models, propagating academic values such as mutual respect, collegiality, inclusiveness and research integrity²⁹ (criterion 4). As a role model they may provide inspiration for under-represented groups or for the implementation of Open Science practices. They lead by example, not only by what they do, but by how they fulfill their duties and roles. Universities and research also need this form of leadership.

All four aspects of leadership will contribute to a stimulating

29 See for instance the Humane Metrics Initiative (<https://humetricshss.org/about/history/>).

and inclusive local research culture. Measuring this local culture through surveys may constitute an indirect way of assessing the leadership performance of senior researchers.

4.2. Collaboration and innovation

Two more transversal dimensions were mentioned in the previous section (see 1.5) i.e. collaboration and innovation. As leadership, these dimensions are not only relevant for research itself, but also for the other domains, such as education or service to society.

Collaboration is also called “collegiate spirit” or “contribution to teamwork” in LERU universities. This dimension refers to the growing importance of team science and team teaching. As mentioned earlier, the romantic ideal of the lone, single-minded individual professor is mostly gone. Research and teaching are more and more a team effort, so strong relationship skills, including conflict resolution skills, must be developed and recognized in the assessment of researchers. Also, a clear commitment to collaboration is needed, and if insufficiently present, challenged by the assessment.

In previous sections of this paper several examples were already given of this dimension, both in terms of contributing to the functioning of a local research team as to an large scale international collaboration. Active participation in scientific networks and service to society also require collaborative skills and attitude. Contacts with media or industry, for example, are supported by good personal relationships with the other party and the ability to understand the context of the other stakeholders. These contexts may be very complex, requiring a combination of empathy and insight, while negotiating skills may be needed to position one’s research group in the collaboration.

Research cannot thrive without **innovation**, which requires experimentation and risk taking, including failure. At least one LERU university asks their researchers to reflect on their initiatives that did not work out, on the choices they made that did not pay off, and what they learned from these failures. Failed attempts may be very important for the advancement of science, but it is hard to get them published. How do you deal with these instances where you did not find anything, or at least anything you considered worth publishing? How do these failures shape your capabilities as a researcher? These reflections, which can be extended to the other dimensions, such as teaching and service to society, are useful elements in assessing a researcher.

4.3. Discussion

We hope that this discussion shows the importance of a developmental perspective in the assessment of researchers. There are several reasons why we need to focus more on this perspective.

First, we all know what happens if collaboration, risk-taking and good leadership are lacking. Scientific opportunities are lost because of fragmentation, conflicts, conservatism and lack of leadership qualities. In the latter case, the result may be a destructive research culture, which is a common reason why good people leave universities or even abandon their research ambitions altogether. Researchers who show leadership, collaboration skills, and resilience in the face of setbacks are essential in the present research environment.

Therefore, universities must invest in the development of these dimensions and send a clear message that they matter. This can only be done by including them explicitly in processes for assessing researchers and thus recognizing their value. In contrast to practices in the past, top publications should no longer be an excuse for bad leadership or lack of collaboration. Secondly, this developmental perspective opens up a perspective of “potential”, balancing the present focus on past achievement. Capabilities to collaborate, lead and build on negative results are important factors that determine the future potential of a researcher. This is especially relevant for hiring, but also for every career advancement step of early-career researchers. Junior researchers may have not “achieved” as much as senior researchers, but by focusing on these dimensions, we can assess their personal and relational maturity as a proxy for their potential as senior researchers.

At this moment, universities pay more and more attention to the leadership dimension. This is a positive evolution, but we believe that in the future similar attention is needed to the other two dimensions: collaboration and innovation. In a context where power distance is eroded by the complexity of the environment and by the values that come with Open Science and with a focus on a sustainable and inclusive research culture, all leadership requires collaboration. The same can be said about innovation, as we need novel ideas more than ever before, and knowing how to deal with setback and failure is a strong component of research leadership today.

The measurement of these dimensions is not easy. Counting the number of PhD students or noting the management position someone has had is absolutely not sufficient. A developmental perspective is fundamentally different from traditional assessment based on past performance. One minimal solution is to look at least for clear deficiencies, which can be revealed from surveys or other material. Some LERU universities have also experimented with self-reflection on these dimensions, where researchers are invited to reflect on their development and skills in a “biosketch”. These experiments support the movement “from numbers to narrative”. The recent “résumé for researchers” from the Royal Society is in line with these developments³⁰. Others, such as the University of Zurich are attempting to measure leadership qualities in interviews (see below).

These examples highlight another essential aspect of the developmental perspective: it does not limit itself to moments of formal assessment, but aims for a permanent process of feedback and self-reflection. Making these dimensions part of the assessment process itself, however, sends a strong signal of importance and opens up opportunities for dialogue between assessments. For a successful scientific career, each researcher needs to be willing and able to reflect on their performance as a researcher and on their development as a person.

30 <https://royalsociety.org/topics-policy/projects/research-culture/tools-for-support/resume-for-researchers/>

5. A contextual perspective

One of the striking characteristics of traditional researcher assessment is that it takes place in a vacuum. Performance is measured and compared in absolute terms. Contextual factors are not acknowledged, or only to a marginal extent. However, researchers operate in a specific context and we know that blinding ourselves to contextual factors may be an important source of bias. If we want to improve the recognition and rewarding of researchers, performance must be assessed in relationship to its context.

5.1. The professional context

One aspect of context that panels and committees should take into account is the professional context of the candidate. One aspect of this context is the popularity or public appeal of a candidate's research topic(s) in the scientific community. Every field has its novelties and controversies. These make some topics "hot" and more attractive for funding. Publications on a controversial or trendy subject may be accepted more easily. Researchers working on less trendy, but by no means less important, subjects may find it more difficult to get funded and published. This may tempt (young) researchers to focus on "easy" questions and readily available data, while avoiding more complex and fundamental questions, for which measurements and data may have to be created from scratch. Some research does require more effort and originality than other, but this is not reflected in any metric we know. The traditional focus on volume of publications may push researchers to "safe" research projects, avoiding maybe more innovative and high-risk questions. This is detrimental for science as a long-term investment as universities do not want their researchers to look for the latest booming fad or to take the easy way in their research.

This point is also relevant for the growth of interdisciplinary research and its importance for the advancement of

knowledge. The balance between disciplinary and interdisciplinary research is shifting. However, researchers working at the crossroads of disciplines and fields often find themselves falling between chairs³¹. Although things are changing, funding and publication channels are still very strongly organized according to traditional disciplinary boundaries, and these sources have a natural preference for "pure" disciplinary research. In a context of scarce resources such as funding or publication space, it is easy to dismiss proposals that could be referred to other disciplines as well. Funders and universities have taken several initiatives to stimulate interdisciplinary research, both in providing resources and in recognizing interdisciplinary efforts, but it remains an uphill battle³².

Another context factor is the particular university situation in which the researcher finds herself or himself. A researcher may be hired or asked to develop a totally new research field in an institution, or (s)he may be part of a large, prestigious and productive research lab. The quantity of research output will be different in each case. Strategic choices are made in a university (e.g. the implementation of Open Science) and it may cost effort for researchers to adapt to these choices. This may have an impact on their research productivity, at least as it is measured today. A university may want to recognize and reward the efforts of those researchers who endorse their overall strategic choices. Such considerations are totally absent from current assessment frameworks. In addition, the evaluation of researchers applying from outside should take into account the situation of the institution the applicant originates from, e.g. in terms of resources (research budgets, infrastructure, support structures). Assessment processes should give sufficient credit to researchers working in small fields, remote geographic areas, or small language communities³³. As leading research institutions, LERU universities have a duty to set the example in this respect.

31 Science Europe workshop on Career Pathways in Multidisciplinary research, Brussels, December 2015 (https://www.scienceeurope.org/media/fdck-ax24/se_legs_careerpaths_workshop_report.pdf).

32 See research from the ShapellID project in Trinity College Dublin [SHAPE-ID: Shaping interdisciplinary practices in Europe - Trinity Research - Trinity College Dublin \(tcd.ie\)](#).

33 Examples are provided by Lebel & McLean (2018) and Valenzuela-Toro & Viglino (2021).

Although the above considerations may be absent from assessment frameworks, creating the impression that research (and other) performance is assessed in a vacuum, the academic context can be represented and included in the process through the composition of assessment panels. To the extent that panels are discipline-specific and composed of local peer researchers, the members of these panels are mostly fully aware of the academic circumstances of the researchers they are assessing. Whether they will take these contextual factors into account in their judgement remains to be seen, but at least there is an opportunity for contextualization. The topic of the composition of assessment panels is further elaborated in the discussion section below.

5.2. The personal context

Things become even more complicated if we focus on another contextual factor, i.e. the personal situation/characteristics of the researcher. Should the assessment take into account the social or other origins of researchers, or the major life events that may have impacted their success? At present the discussion focuses on the time researchers had available to produce their research output, and looks primarily into family situation, gender differences and teaching load. The discussion, however, is also relevant for broader aspects, such as researchers combining their academic positions with professional or clinical practice (e.g. clinical work in hospitals or other clinical or social service settings, in law work, or in interpreting, to name just a few possible instances), or cases of intersectoral mobility with industry. The assessment ideal to which each application is compared is that of a full-time researcher with few other obligations. Academic careers are assumed to be linear and equally paced. Since hiring and promotions are normally highly competitive, people with substantial family or patient care duties, a significant teaching load or a sidestep towards industry, are in a disadvantaged position.

Accounting for “research time” is controversial, since this reinforces the undesirable focus on volume as a criterion. If we want to get rid of the idea that a researcher with 40 publications is a better researcher than one with 30 publications, the issue

of “research time” should be addressed from a qualitative perspective instead. The concept of “**academic age**” as e.g. practiced in some faculties of the University of Zurich may be a first step³⁴.

Most LERU universities have taken steps against assessment bias, as personal contextual factors go far beyond the issue of research time. In many cases the composition of assessment panels offers some improvement. Traditionally, panels are filled with “established” researchers, reflecting the composition of the researcher workforce 20 years ago. Broadening panels and committees with junior, female, disabled or minority members will increase the attention paid to context. In order to increase the diversity of perspectives, LERU universities are experimenting with including students and part-time researchers on these panels.

An original approach to avoid bias to disadvantaged groups, called “contextual recruitment”, has recently been developed in the UK outside of the university context³⁵. Based on large-scale application statistics, the level of “disadvantage” of applicants is visualized. Candidates with fewer opportunities are thus “lifted” to receive a similar level of attention from the recruitment committee as candidates with a more “standard” background. The approach has apparently succeeded in breaking the traditional pattern of top legal companies in the UK recruiting only from a very limited number of top schools. In academia you will also find high ranked universities who exclusively focus in their recruitment on people coming from other high ranked universities. On an individual level, this reduces the opportunities for young researchers who started their career in a less prestigious institution, on a macro level this leads to a waste of talent that goes undetected. In an environment where the competition for excellent researchers is real, helping universities to open up their recruitment base will always be a good idea.

5.3. Discussion

Contextualization in assessment is controversial, and not only in academia. The universalist point of view, which

34 Applicants are required to state their full time equivalent working time in academia since acquiring a doctorate, but the candidates do not disclose the reasons why they have spent time away from academia, which safeguards the process against potential biases. The hiring committee subsequently views the information about each applicant in the context of their individual academic age. For more context, see: <https://www.mnf.uzh.ch/en/mnf-gleichstellung/counteractingBias.html>. A definition of academic age can be found on Wikipedia (https://en.wikipedia.org/wiki/Academic_age).

35 See <https://contextualrecruitment.co.uk/>

36 <https://www.uu.nl/en/news/utrecht-university-presents-new-vision-on-recognition-and-rewards>

is represented in bibliographic and other metrics, sees performance as something absolute, to be assessed by a universal measure. Excellent research is excellent research, regardless of the circumstances in which it was produced. On the other side, the particularistic point of view looks at an achievement precisely in relation to the context in which it was produced.

Most assessment panels try to combine both perspectives by demanding a certain level of absolute performance, while judging the researcher's contributions and overall achievements in relation to their context. Maintaining a balance between the two is not easy and cannot be translated into uniform rules. The debate on the usefulness of the concept of "research time" and "academic age" illustrates this difficulty.

In the previous sections we referred to the more local and diverse composition of assessment committees as a road to greater contextualization. The French systems is an example of this idea. Professors are promoted through a national contest with national assessment panels. These panels operate from a distance and use very traditional, narrow criteria of research excellence. But in recent years, positions have been granted to universities as well, so that universities can promote professors to a higher grade when they have not made it in the national competition. In general, French universities tend not just to pick up those who did not make the cut in the national competition, but rather focus on criteria other than those of the national panels, e.g. by giving more weight to education and to service to society or the institution.

Local committees, however, may suffer from too much contextualization, thus losing the detachment needed for an assessment. Moreover, they may be less familiar with research cultures or institutional contexts other than their own. Local assessors often know the candidates personally and may have preconceived ideas about the value of their work. This makes them vulnerable to bias or conflicts of interest. So the composition of assessment panels is no panacea for contextualization, although LERU universities are working towards more diversity in their committees.

What we are missing so far is a set of good examples of contextualization and an agreed idea of the contextual information we need to make appropriate assessments. Universities may start by documenting contextualizing considerations, in relationship to diverse researchers' profiles. We believe this may help to substantiate sound contextual

judgement in recognizing a diversity of contributions and raise contextualization beyond voluntarism.

One road to contextualization may be inspired by the mutual obligations that KU Leuven applies in a Tenure Track appointment agreement. At such an appointment, the starting professor and the university make an agreement of what they expect from one another. Next to the expectations that the researcher needs to fulfill at the end of the Tenure Track period, the agreement also includes a set of precise obligations from the university, such as the availability of funding or support. The assessment panel that judges the researcher's performance at the end of the Tenure Track period must take into account whether the university has fulfilled its obligations and adjust the researcher's assessment in the light of this context.

6. Steps to a more comprehensive assessment of researchers

So far this paper has elaborated a LERU framework for the assessment of researchers. In this section we describe the specific actions and efforts LERU universities take today in order to develop an assessment practice that is more diverse and inclusive.

1. A first step is to build a more diverse assessment model, which is more inclusive and responsive to a variety of contributions from researchers. The LERU framework elaborated in this paper may be an inspiration to do so, although a university will want to translate this framework to its own particular identity and context. One example is Utrecht University, which recently proposed a new model of assessment based on a new vision on recognition and rewards. Their TRIPLE model combines the three domains in which the university generates outcomes (Education, Research and Professional performance) with three dimensions reflecting how the university wants to work (Team spirit, Leadership and Impact)³⁶.
2. In order to apply a diverse assessment model, there is a need to change the information that is requested from candidates or from researchers who apply for a promotion or who are subject to evaluation. There is a lot happening in LERU universities in this respect. There is a clear tendency to complement numbers (counts) with narrative and self-reflection, as mentioned earlier in this paper. One example is a new CV format that has been implemented recently at the Medicine faculty of the University of Geneva³⁷, where candidates can comment on different aspects of their CV.

Narrative formats must be designed with care in order to offer the desired benefits. Researchers may be skeptical about self-reflection in a competitive environment and panel members should not be flooded with unstructured information. KU Leuven has experimented for several years with a “biosketch” model, in which it asks candidates for professorship to reflect on their past performance and their future ideas and plans. The biosketch complements a

tradition of asking candidates to list the five most important achievements of their career, and to motivate their choice. It also allows the inclusion of contextual information, which may be useful to assessing overall performance. The biosketch is an important tool to support selection interviews with new external candidates. The University of Cambridge is in the process of applying the Résumé for Researchers form developed by The Royal Society³⁸. Another example is provided by the University of Freiburg, where the assessment of tenure track professorships is based on a self-report, which is comparable to the other examples. The self-report consists of a personal statement and documentation. In the statement the tenure track professor has the opportunity to present and weigh his or her priorities and choices, not only focusing on successes, but also on problems and how they can be addressed.

A common factor in all these examples is that the assessed researchers themselves structure the information in their application file, highlighting their specific contribution profile themselves. In this way the focus of the assessment panel can be directed to the most relevant information. The downside of these narrative forms is that they need to be restricted in terms of length, a practical measure that may have a differential impact on different profiles of researchers.

Another common factor is that LERU universities combine this narrative information with quantitative data. They believe that a combination of both types of information (qualitative and quantitative) is the best guarantee for sound judgement and for the recognition of a variety of contributions from the researcher.

3. One specific issue is to develop measurements for the dimensions we discussed in the developmental perspective. How to measure aspects of leadership and leadership skills? How to assess the potential of an early-career researcher in terms of innovation or collaboration? Some examples have been given: the result of leadership

³⁷ <https://www.unige.ch/medecine/fr/organisation/rh/carrieres/>

³⁸ <https://royalsociety.org/topics-policy/projects/research-culture/tools-for-support/resume-for-researchers/>

surveys, the career progress of early-career researchers that the researcher mentored, or self-reflection on topics such as resilience and interpersonal skills. The University of Zurich is experimenting with elaborate, structured leadership interviews during professorial appointments. These interviews are developed, individually tailored, conducted and analyzed by psychology researchers from the university, while the candidate's answers during the interview are rated by the members of the recruitment panels. Such projects are very promising and more experimentation is needed.

4. Attention can be given to the assessment process itself and how different stakeholders are involved in it. LERU universities have experimented with the involvement of PhD students, postdocs, undergraduate students and local colleagues in the process of selecting and assessing candidates for a senior researcher position, and in the process of evaluation. Specific roles have been accorded in panels to reduce bias and increase a diversity perspective. Every hiring and promotion committee at KU Leuven has an appointed a "gender guard", who is a full member of the committee and who has volunteered to take on this role. These gender guards are then trained to recognize and counteract different forms of bias. The experience to date suggests that the name of this role should be changed, since its impact goes far beyond gender issues. Other universities, such as the University of Geneva and the Lund University, have followed another path. They have added trained observers to recruitment and promotion panels, in order to give outside feedback to their deliberations and help prevent bias in judgements. At the University of Geneva these observers (called "délégués à l'égalité") are not part of the decision-making process, allowing them to execute their role in a more independent way, while at Lund University they may take part in the decision-making.
5. In order to broaden the views and practices of assessment panels, LERU universities have begun systematic efforts to train their panel members. In general, panel members are established and respected researchers themselves and have a very good view on the scientific challenges and developments in their fields. They may be trained and experienced in assessing scientific proposals and

papers, but they are not always as skilled in assessing people. Today, the training provided in LERU universities is mainly oriented towards the assessment philosophy and instruction on how to use the information provided by candidates. Some universities such as University College London³⁹ and the University of Zurich have elaborate instructions on how to use metrics in the process of an assessment. Other universities, such as Leiden University, Utrecht University, the University of Copenhagen, and the University of Cambridge, offer detailed instructions to panel members in how to use their career framework.

One interesting example is the new framework "Academia in Motion" at the University of Leiden. It not only elaborates new principles of assessment, but also focuses on why this new assessment is needed, and lists a number of dilemmas that this new practice will entail⁴⁰.

6. Finally, the university governance should communicate to its researcher community its view on researcher assessment and show its commitment to recognize and reward more diverse contributions. This implies communication on the new assessment framework, the worldview behind it, and the way it will be applied and translated into funding opportunities and career progress principles. It also requires communication on what the university is going to do to ensure that the broader framework will be implemented by local panels and decision makers. Many of these local panels will be inclined to continue to work as they are doing now.

The university will also need to show in its actions that it is prepared to switch its focus away from the top predators and take more care about the rest of the research ecosystem. This requires a debate on what is considered to be the definition of "excellence", whether it is in research, education or leadership. The TRIPLE model of Utrecht University can be mentioned as an example.

39 <https://www.ucl.ac.uk/library/research-support/bibliometrics/ucl-bibliometrics-policy>

40 <https://www.universiteitleiden.nl/en/news/2021/01/academia-in-motion-a-different-form-of-recognition-and-reward>

7. Conclusion and key messages

This paper builds on the knowledge and experience of LERU as a community. It aims to inspire future ways of assessing researchers that fit with a concept of science as a community. Such ways should improve the independence, objectivity and the relevance of the assessment, leading to more recognition and reward for diverse contributions to science and society.

LERU universities are already using **a broad range of criteria** in assessing researchers, both in their research mission, and for education and service to society. Although they may use publication metrics, these metrics are always complemented with other indicators of quality and performance. More and more qualitative information is used in their assessments, in order to avoid the biases that accompany quantitative indicators. Developmental and contextual factors must be included in the assessment. The broader range of criteria must be applied from the start of the assessment process, and not limited to a shortlist of candidates. It is very tempting to use traditional metrics for reducing the number of candidates for a position, and then apply a broader framework to those on the shortlist. This, however, is one of the mechanisms of exclusion that has led to the criticism on the use of metrics in the first place. LERU universities are also constantly adapting their assessment processes and experimenting with new practices. Some of them are mentioned in the previous section.

In general, the assessment of researchers is still **too strongly focused on past performance**, which is further reduced to exceptional and individual achievements. This insufficiently values all the other work that is necessary to create the innovative research ecosystem that we need in and beyond our universities. LERU universities are struggling to find a balance between rewarding exceptional individual achievements and providing recognition for a lot of invisible work that has also contributed to these individual achievements. By focusing on indicators of top performance, one does not get an appropriate view on the entirety of a researcher's contribution. Some of their contributions may be lost in the assessment process.

Assessment is also still **strongly focused on individual output**, at the expense of criteria that focus on the processes that lead to such outputs. Recognition of the contribution to these processes in a context of team science and collaboration is largely lacking. A developmental perspective may help

to go beyond the traditional individual output perspective. Leadership, collaboration and innovation should not be assumed or inferred from outputs. These dimensions should be assessed directly, stimulating development and identifying future potential. This would acknowledge the importance of the leadership dimension, both in showing leadership in itself, as in the kind of leadership you demonstrate.

The traditional focus on individual outputs misses a number of important contributions to the modern science endeavor, such as the practice of Open Science, openness to interdisciplinary and intersectoral collaboration, the education of the next generation of researchers, team-science, life-long learning, service to the institution and outreach to society. LERU universities should reflect on how they can give these dimensions a stronger emphasis in their assessments and career models.

Several LERU universities are **experimenting with their assessment frameworks and processes**. The previous section lists a number of examples. By developing their frameworks, they aim to improve the recognition for their researchers over a broader range of contributions, to be more inclusive to different academic profiles, and to improve their science, their education, and their service to society. They also want to focus more on the local research cultures they offer to their young researchers, who will become the next generation of research leaders. Although LERU universities may have an excellent overall track record in offering a positive and stimulating environment for young researchers, there is still a long way to go to ensure that the pressure on senior researchers does not lead to a toxic research culture in some research groups.

Finally, we want to point out that creating a new practice in assessing researchers is **not an easy task**. There are several reasons why this may be the case.

First, the assessment process may become more time-consuming, requiring more time investment from applicants, panel members and professional support staff. Recognizing a broader diversity of contributions may decrease the clarity of what really matters in an application. This may lead to more pressure on researchers, who may experience the new assessment outlook as a way of increasing current performance standards. It may make them insecure and risk-

averse. However, what science needs is researchers who want to experiment with novel ideas, not people who check boxes on an assessment list. So universities have to make sure they keep room for the quaint and for counterintuitive initiatives.

Second, the recognition of a vast diversity of contributions implies a large set of criteria some of which may seem incompatible with others. It is difficult to structure this diversity into a practical overview, without creating implicit (and undesired) hierarchies between profiles of researchers and again excluding some contributions. Universities need to acknowledge differences between fields respecting what is highly valued, but at the same time want to remain fair over disciplines in their career decisions. A uniform and strict assessment process may provide comparability and comfort, but unfortunately it will conflict with the diversity of careers and profiles we want to recognize and stimulate. Given the consequences of the assessment process (hiring or promotion), striking the right balance will always remain a delicate operation and the process will be messy.

Third, in some countries universities have limited autonomy to organize the assessment of their researchers. National bodies may have a strong direct influence on selection and promotion processes, or state regulations or guidelines may invalidate assessment criteria that the universities want to apply. Although there are countries (such as the Netherlands and the UK) in which evaluation processes are aligned with the principles of DORA and Open Science, in many other countries this is not the case.

Fourth, universities do not operate in a vacuum as researchers are members of international scientific communities. These communities may not subscribe the ideas that were elaborated in this paper. Also, the way governments, funders and league tables define and evaluate research performance may be strongly based on traditional output measures. LERU universities do not want to disconnect themselves from the international scientific world, with its global competition in funding, ranking and reputation. It remains a challenge to fit their new ways of assessing researchers with the ways their own (research) performance is evaluated. In some cases this consideration was an explicit concern for a LERU university board when deciding on a broader and more diverse recognition of contributions in the assessment of researchers.

As LERU universities will be further inspired by this common framework, both the framework itself and the instruments necessary to implement it, will develop and evolve in the

coming years. This will require time and room to experiment. We hope this paper will encourage policy makers in governments and in funding agencies to support this process and to provide the space and resources for experimentation that universities need in order to improve their assessment of researchers.

List of references

- Adams, S., Bekker, S., Fan, Y., Gordon, T., Shepherd, L., Slavich, E. & Waters, D. (2021). Gender Bias in Student Evaluations of Teaching: 'Punish[ing] Those Who Fail To Do Their Gender Right', *Higher Education*, March 2021, <https://doi.org/10.1007/s10734-021-00704-9>.
- Boring, A. (2017). Gender biases in student evaluations of teaching, *Journal of Public Economics*, Vol. 145, 2017, pp. 27-41.
- Braun, Y., e.a. (2017). The Burden of Invisible Work in Academia: Social Inequalities and Time Use in Five University Departments, *Humboldt Journal of Social Relations*, vol. 39, pp. 228-245.
- Cooper, M. (2021). Research: Women Leaders Took on Even More Invisible Work During the Pandemic, *Harvard Business Review*, October 2021. Retrieved from <https://hbr.org/2021/10/research-women-took-on-even-more-invisible-work-during-the-pandemic> at October 27, 2021.
- de Rijcke, S., Waltman, L. & van Leeuwen, T. (2019). Halt the h-index. Retrieved from <https://www.leidenmadtrics.nl/articles/halt-the-h-index> at September 16, 2021.
- de Rijcke, S., Wouters, P., Rushforth, A., Franssen, P., Hammarfelt, B. (2016). Evaluation practices and effects of indicator use—a literature review, *Research Evaluation*, vol. 25, Issue 2, April 2016, pp. 161–169.
- Hirsch, J. (2020). Superconductivity, What the H? The Emperor has no Clothes, *Forum for Physics and Society*, Jan. 2020. Retrieved from <https://arxiv.org/ftp/arxiv/papers/2001/2001.09496.pdf> at September 16, 2021.
- Humane Metrics Initiative, <https://humetricshss.org/about/history/>.
- Kuhn, T. (1962). *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.
- Lakatos, I., & Musgrave, A. (Eds.). (1970). *Criticism and the Growth of Knowledge*. Cambridge: Cambridge University Press.
- League of European Research Universities. (2008). *What are universities for?* Retrieved from <https://www.leru.org/files/What-are-Universities-for-Full-paper.pdf> at September 16, 2020.
- League of European Research Universities. (2017). *Productive interactions: Societal impact of academic research in the knowledge society*. Retrieved from <https://www.leru.org/files/Productive-Interactions-Societal-Impact-of-Academic-Research-in-the-Knowledge-Society-Full-paper.pdf> at September 16, 2020.
- League of European Research Universities. (2017). *Interdisciplinarity and the 21st century research-intensive university*. Retrieved from <https://www.leru.org/files/Interdisciplinarity-and-the-21st-Century-Research-Intensive-University-Full-paper.pdf> at September 16, 2020.
- League of European Research Universities. (2018). *Implicit bias in academia: A challenge to the meritocratic principle and to women's careers – And what to do about it*. Retrieved from <https://www.leru.org/files/Publications/Implicit-bias-in-academia-Full-Paper.pdf> at September 16, 2020.

- League of European Research Universities. (2018). *Delivering talent: Careers of researchers inside and outside academia*. Retrieved from https://www.leru.org/files/LERU-PP-DeliveringTalent_2018-June.pdf at September 16, 2020.
- League of European Research Universities. (2019). *Equality, diversity and inclusion at universities: the power of a systemic approach*. Retrieved from https://www.leru.org/files/LERU-EDI-paper_final.pdf at September 16, 2020.
- League of European Research Universities. (2020). *Towards a Research Integrity Culture at Universities: From Recommendations to Implementation*. Retrieved from <https://www.leru.org/files/Towards-a-Research-Integrity-Culture-at-Universities-full-paper.pdf> at September 16, 2021.
- League of European Research Universities. (2020). *Tomorrow's Teachers Today: What Universities Can Do for the Teaching Profession*. Retrieved from <https://www.leru.org/publications/tomorrows-teachers-today-what-universities-can-do-for-the-teaching-profession> at September 16, 2021.
- League of European Research Universities. (2021). *Implementing Open Science*. Retrieved from <https://www.leru.org/files/Implementing-open-science.pdf> at September 16, 2021.
- Lebel, J. & McLean, R. (2018). A better measure of research for the global south, *Nature*, vol. 559, July 2018, pp. 23-26.
- Longino, H. (2001). *The Fate of Knowledge*. Princeton: Princeton University Press.
- Popper, K. (1959). *The Logic of Scientific Discovery*. New York: Basic Books.
- Toulmin, S. (1990). *Cosmopolis. The Hidden Agenda of Modernity*. Chicago: University of Chicago Press.
- Valenzuela-Toro, A. & Viglino, M. (2021). How Latin American Researchers Suffer in Science, *Nature Career Column*, Sept. 2021. Retrieved from <https://www.nature.com/articles/d41586-021-02601-8> at September 16, 2021.

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