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Quality of research: which underlying values?

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Abstract Traditional bibliometric indicators are considered too limited for some research areas such as humanities and social sciences because they mostly reveal a specific aspect of academic performance (quantity of publications) and tend to ignore a significant part of research production. The frequent misuses (e.g. improper generalizations) of bibliometric measures results in a substantial part of the research community failing to consider the exact nature of bibliometric measures. This study investigates the links between practices for assessing academic performance, bibliometric methods' use and underlying values of research quality within the scientific community of University of Lausanne, Switzerland. Findings reveal four researcher profiles depending on research orientations and goals, ranging from those using "pure" quantitative tools to those using more subjective and personal techniques. Each profile is characterized according to disciplinary affiliation, tenure, academic function as well as commitment to quality values.

Keywords Research quality · Quality values · University profile · Researcher's typology · Swiss university · University of Lausanne · MCA · Vocabulary use

Introduction

The academic world, as in any social entity, has an intrinsic culture based on *values* and characterized by a set of rituals and symbols that help it distinguish from the others and ensure consistency and continuity of its members (Hofstede 2001). Once acquired, the values that form the core of any culture, influence the way the world is conceived and operated (Kroeber and Kluckhohn 1952). In the academic context, these values are present at any institutional level and are transmitted by the academic departments: they refer to beliefs and principles that guide university life and work. Among them, some values, like academic freedom, search for truth, honesty or collegiality, are shared by all (Harman

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2010), others, such as conviviality, collaboration or teaching valorization, are domain, faculty or institution specific.

This study examines values underlying a crucial aspect of academic activity: the research. Researchers are constantly in situations where they are evaluated by peers: in applying for funds, during project or paper submissions, in recruitment or promotions. The *value* of an article, a project or an application is weighed, its *quality* assessed even though these two concepts are not well defined. It is important to make the distinction between the *values* promoted by an individual or a group on quality research and the judgment that one has concerning the *value* of a research. Very often these two levels are confounded. The value given to a paper implicitly assumes that there is a common scale for measuring a scientific work while there are several scales based on underlying values. Considering the fact that all choices made by an individual are based on *values* (Harland and Pickering 2011), a better understanding of those that underlie research has important implications for research assessment and helps define its quality.

Research quality

In general, a universal and unambiguous definition for the concept of quality does not exist, but different definitions adapted to each circumstance do (Reeves and Bednar 1994). For academic research in particular, the definition is even more complex. In this context, this concept is becoming increasingly synonymous with *excellence*: always be the best, belong to the elite, get better results than the others, etc. Because of the growing importance of international visibility, the pursuit of excellence is also intensified by the pressure of university rankings. Moreover, many European universities are launching initiatives to encourage "research excellence". Therefore, the goal of the *Exzellenzinitiative* of German universities[1] or *Initiatives d'excellence* in French higher education[2], is "to compete with top universities in the world". Similarly, research quality evaluation systems in the UK higher education institutions, the *Research Assessment Exercise* (RAE), was replaced by *Research Excellence Framework* (REF)[3] in 2008. This highly competitive environment implies being able to evaluate research in accordance with international standards. Thus, research quality assessment is of prime importance and at the same time problematic. Indeed, limiting the notion of quality to *excellence* only neither sets standards for measuring it nor defines exactly what is meant by it. From this perspective, quality is obvious, it goes without saying, is something "special" that we recognize instinctively (Harvey and Green 1993; Lamont 2009).

What is quality research, what is research excellence? What are the values on which these concepts are built? How to evaluate them?

Because the values underlying excellence are implicit as well as subjective choices, their assessment is difficult as well. The most widespread solution for proper assessment is by means of quantitative indicators which are also the basic measure of the rankings, recognized as the emblem of excellence in most academic circles.

Today on *Web of Science*, *Scopus*, *Google Scholar* or *Publish or Perish* (Harzing 2007) most quantitative indicators are available: in a few clicks one can quantify scientific productivity and a scientist's impact based on his *h-index*, namely the level of his

[1] http://www.dfg.de/en/magazine/excellence_initiative/index.html. Accessed 9 Jan 2012.

[2] http://www.agence-nationale-recherche.fr/investissementsdavenir/AAP-IDEX-2010.html. Accessed 9 Jan 2012.

[3] http://www.hefce.ac.uk/research/ref/. Accessed 9 Jan 2012.

publications' citation (Hirsch 2005) or by giving more weight to highly-cited articles (*g-index*, Egghe 2006). Impact factors developed by Garfield (1979) are commonly used for the evaluation of scientific production of individuals, teams, universities or countries. Higher education institutions of the whole world identify their research activities by making use of scientometric indicators. Thus, for example, we see their application for estimating public universities' efficiency in Greece (Katharaki and Katharakis 2010), for national research performance evaluation in Holland (Moed et al. 1995), for research institutes' assessment of the Hungarian Academy of Sciences (Vinkler 1998), for detecting a department in difficulty in Sweden (Staropoli 1991), etc. The quest to find new, more efficient indicators is always present (see for example the corrected *h-index* for Brazilian, Portuguese and Spanish universities' performance estimation, Vieira and Gomes 2010) with the aim to build more precise research assessment exercises which consider the diversity of scientific activity (e.g.: Spain, Ortega et al. 2011). To complete existing statistical indicators some institutions, such as the *Observatoire des Sciences et des Techniques* (OST)[4] in France, produce indicators for each stakeholder of a research (e.g., a country, a region, an institution) in order to characterize its scientific activity, to compare it to the activity of its partners or competitors, to follow its evolution over time.

At present, these quantitative techniques are increasingly used as tools for performance and quality evaluation of researchers, teams, institutions, or even a nation. However, quantitative scientometric techniques were originally designed as an aid to understanding scientific community evolution and its paradigms. Among them, remember the Anglo-Saxon bibliometric current that was interested in studying scientific interest fluctuations of a given period (e.g.: anatomy literature directory between 1850 and 1860, Cole and Eales 1917), modeling journals' distribution according to their ability to cover a scientific field (see: Bradford's law, 1948), or the sociological current which postulates that scientific activity is governed by sociological rules (Price 1963). Moreover, the term *наукометрия*—science measurement, scientometrics—introduced by Nalimov in 1969, aimed to study science development through quantitative methods to identify new research directions especially for exact sciences and engineering. In his book that represents the first comprehensive monograph on quantitative methods for studying science development, science is seen as an information process (Налимов et Мульченко 1969).

Far from their original function, these techniques represent today the key tools of the strategy of policy makers (Esterle 2007). In addition, very few researchers understand what these indicators really measure and most of them do not wonder about the epistemological basis of these indicators (Gingras 2008). The goal in our days is to create indicators that assess research activity, measure research actors' productivity and their strategic position (Rostaing 1996), rather than study science's sociological aspects. From this point of view, a publication is the essential trace of scientific activity and the "notoriety", being cited, is an indicator of "influence" of an author (Coutrot 2008). Therefore, among other things, we can "measure" the quality and intellectual contribution by citation numbers, by impact factor (Hayati and Ebrahimy 2009), by collaboration numbers (Barnett et al. 1988; Endersby 1996), by calculating journal's influence (*eigenfactor*, Franceschet 2010), or characterizing scientists' eminence by the determination of the impact of their most influential publications (*π-index*, Vinkler 2009).

The consequence of using this kind of data is unavoidable: their misuse interferes with decision making, with evaluation of individuals and teams, in areas where these techniques are not directly applicable (e.g. humanities), (Vinkler 2008). Publications in specialized

[4] http://www.obs-ost.fr/. Accessed 19 Sept 2012.

journals and citation rankings have become major indicators of universities and scientific values and largely determine scientists' careers. This observation process and performance evaluation can influence to the point, that Horne et al. (2009) note the emergence of a range of socially undesirable even pathological behaviors associated to certain indicators use such as the *h-index*.

In this comparative perspective, having "excellence" as implicit and single criterion rejects completely the idea that research quality can be composed of several underlying values. However, the academic world represents lots of diversities, where institutions' missions evolve over time, vary according to disciplines and teams, "where qualitatively incommensurate proposals cannot be subsumed under a single standard" (Lamont 2009, p. 200). The notion of quality of research reduced to that of excellence is not operational. But trying to understand this concept is important because, due to increasing globalization and internationalization, higher education institutions around the world should be accountable to the stakeholders, both at a national and international level. Institutions have the responsibility to inform investors on their performance and effectiveness. The evaluation is used to give the investors' confidence and ensure the legitimacy of institution's sector (Stensaker and Harvey 2011).

In the evaluation process opposed trends are observed. On the one hand, there is a vision of research quality measurement solely based on the application of quantitative tools. In that perspective only outputs are taken in consideration (Hood and Wilson 2001) and the quality is reduced to *one* of its underlying values, namely the result in term of number and impact of publication. On the other hand, some researchers although they have a broad vision of quality, have a reductive view of scientometrics and thus are against using it in evaluation. Due to the fact that scientometrics is a science that is "comprehended by some and misunderstood by many" (Smith 2012, p. 425) its acceptance is hindered by the fact that it is often reduced to only bibliometrics. However, scientometrics, using methods from the natural as well as social and behavioral sciences, is a quantitative study, which aims to advance knowledge on the development of science and technology, taking into account policy issues and society development. The quantitative, bibliometric study of the scientific output is only one of its aspects (Van Raan 1997, p. 205). Reduction of scientometrics to bibliometrics is identified by Glänzel and Schoepflin (1994) as one of the potential reasons of scientometrics' crisis.

To achieve the goal of understanding the value and the quality of research, some authors attempt to break away from the unique idea of excellence and try to understand what this concept really means. By analyzing interviews with experts during American universities' peer review, Lamont (2009) concluded that in the vast and multifaceted universe of academic evaluation, concepts such as originality and quality are defined in a multitude of ways. According to her results, six criteria allow panelists to recognize an excellent work: clarity, quality, originality, significance, methodology, feasibility. Each discipline has its own definition of what they mean by these criteria and give them different weights.

Similarly, Hemlin and Montgomery (1990) and Hemlin (1993), studying Swedish scientists quality representations, concluded that research quality could be characterized by seven factors: (1) quality indicators: "objective" (e.g. frequency of citations) or "subjective" ones (e.g. peer reviews); (2) the research effort (research "size"); (3) the researcher (e.g., personality and skills); (4) the research environment; (5) intra- and extra-scientific effects (e.g. contribution to knowledge); (6) research policy and organization (e.g.: society and scientist's policy) and (7) research financing (e.g. public or private). The author emphasizes that "these seven factors interact and form a framework in which different meanings of the concept "scientific quality" may be traced" (1993, p. 27) and that they vary by discipline.

Hence, quality and scientific excellence appear as complex concept. Given that there is no universal definition, the challenge is to provide useful and relevant methods for assessing it for a specific domain, taking into account its diversity and understanding the values they covers.

Objective of this work

This study lies in the heart of this multifaceted and competitive academic environment. Like other European universities Swiss universities also feel the need to develop their skills in research performance benchmarking at international level. Autonomous, they are accountable for their academic 'production', hence, need to "measure" the performance and quality of their research. From this perspective, in 2008, the Rectors' Conference of Swiss Universities implemented the "*Measuring the research performance*" project[5]. It aims to develop a verification system for universities' intellectual contributions with an emphasis on humanities and social sciences. This study was realized at the University of Lausanne (UNIL) between February and June 2011.

We do not aim to criticize the way quality is measured by quantitative, bibliometric tools. These techniques, applied carefully, can be very important, when they are used with rigor and critical thinking as an information to support expertise (Filliatreau 2008, p. 62). Scientometric evaluation is "as strong medicine, if the diagnosis is correct, professionally applied, helps the healing process, otherwise it does more harm than if it had not been used" (Vinkler 2004, p. 793). The objective of this paper is rather to draw attention on two main aspects. First, it appears essential to us to break the narrow vision of quality, stressing that it is not based on single *value* but several underlying *values*. Second, for better acceptance of scientometrics, it appears important to us to highlight that it cannot be reduced to the study of outputs only. In fact, research quality evaluation using scientometric tools is a pertinent method if they are applied with a "clear, empirically supported set of conditions determining the applicability of indicators" (van Raan 1997, p. 214). One should rather reflect upon this concept, in an attempt to find "appropriate doses" and possibly make use of alternative techniques based on the needs of specific disciplines. By studying the case of one of the best universities in Switzerland, we attempt to clarify what researchers mean by research *qualities* and not *quality*, what their values and needs are in this area.

Therefore, two main questions guided our approach:

1. What are the (shared/specific) institutional values associated with research quality?
2. Are the choices of values linked to researchers' familiarity with bibliometric approaches?

Method

Context

As a worldwide recognized academic institution, University of Lausanne's (UNIL) role is to promote and support research, recruiting top researchers capable to share their

[5] http://www.crus.ch/information-programmes/projekte-programme/projet-mesurer-les-performances-de-la-recherche/projet-2008-2011.html?L=1. Accessed 9 Jan 2012.

knowledge, encouraging younger generation, and enhancing the results of their research[6]. UNIL, a French speaking university, is composed of approximately 2'300 teachers and researchers, 950 administrative and technical staff and has over 12'000 students from more than 86 countries.

UNIL is composed of seven faculties:

- Faculty of Theology and Religious Studies (FTSR)
- Faculty of Law and Criminal Justice (DROIT)
- Faculty of Arts (LETTRES)
- Faculty of Social and Political Sciences (SSP)
- Faculty of Business and Economics (HEC)
- Faculty of Geosciences and Environment (FGSE)
- Faculty of Biology and Medicine (FBM)

Procedure

Our study was preceded by an exploratory phase, consisting of a series of semi-structured interviews with a representative sample of officials of each faculty. This phase allowed us to realize that there are two trends. First, whatever the field in which we use scientific activity evaluation, natural or human sciences, there is a common element among scholars: the lack of clarity about its definition. Second, there is a wide range of ways in which bibliometric tools are approached, from their "anarchic" and "savage" use, to an emotional reaction of opposition or even denial of their existence.

Considering this vagueness, we believe it is imperative to examine more closely the population that is most affected by these questions: the researchers themselves. Thus, a questionnaire was developed to elucidate concepts, representations, or "fantasies" that academics have concerning scientific research assessment.

Instrument

The questionnaire consists of two parts. In order to study researchers' idea on the quality research concept and to increase responses freedom, the quality aspect is assessed by two open-ended questions in the first part of the questionnaire. The second part concerns evaluation practices and bibliometric assessment methods (closed questions). The order of questions was the same for all respondents. Aiming to limiting the influence of prior responses, we decided to start the questionnaire with the two open-ended questions. Table 1 shows the quantitative description of the questionnaire and Appendix contains the complete questionnaire.

From a total of 1,368 online invitations we had 389 replies, including 20 duplicates and a tripling. After cleaning them up, we were left with 367 responses, representing just over a quarter (26.8 %) of the invitations. Faculty representation by respondents was proportional to the real size of faculties ($\chi^2(6) = 9.33$, $p = .15$).

Participants' characteristics

Among the respondents, 339 answered in French, 26 in English and two in mixed French and English. We limited ourselves to French responses, since we observed significant

[6] http://www.unil.ch/recherche/page53293.html. Accessed 9 Jan 2012.

Table 1 Description of the questionnaire distributed at the University of Lausanne

Questions	*N*
Part 1	
Quality representation	245
Good researcher definition	258
Quality research definition	246
Part 2	
Researchers' profile evaluation in the following situations	
Appointment or promotion of a faculty member (*Profil_Prof*)	145
Appointment or promotion of an intermediate staff member (*Profil_CI*)	140
Financing in order to encourage an academic career (*Profil_Encouragement*)	102
Awarding of a prize or distinction (*Profil_Prix*)	94
Projects' evaluation in the following situations	
Revising a journal article, a book, a book chapter for publication (*Projet_Article*)	229
Preliminary assessment or public criticism of a symposium paper or conference (*Projet_Colloque*)	173
Evaluation and grading of a bachelor's or master's thesis or a PhD dissertation (*Projet_MÕmoire*)	221
Research project assessment related to a request for funding (*Projet_Fonds*)	182
Use of bibliometric indicators	
To evaluate a scientific journal (*BibRevue*)	122
To evaluate researchers' profile (*BibChercheur*)	100

Abbreviations of questions used in Multiple Correspondence Analysis (Quantitative Analysis) that are also represented at Fig. 1 are in italic

differences between the respondents who give their answer in French ($n = 339$) and those answering in English ($n = 26$). These differences concern the assessment profile in career encouragement ($\chi^2(1) = 6.29$, $p = .012$), bibliometric indicators' use in evaluating journals ($\chi^2(1) = 7.48$, $p = 0.0062$) and the assessment of researchers profile ($\chi^2(1) = 11.91$, $p = 0.0005$. The characteristics of the final sample are summarized in Table 2.

Analysis

On the one hand, our goal was to study researchers' familiarity with evaluation practices and the way they position themselves in relation to the bibliometric indicators use. On the other hand we aimed to discover the institutional values associated with quality academic research. We proceeded in two steps. First, in the *Quantitative analysis*, a Multiple Correspondence Analysis followed by a Cluster Analysis were conducted on responses to closed questions on evaluation and bibliometric attitude. Second, in the *Qualitative Analysis*, open-ended questions were included in the analysis to highlight the values of quality research. Quantitative analysis was processed with SPSS 19 (Statistical Package for the Social Sciences, SPSS, Inc., Chicago, IL, USA)[7], which is a large package that has been long used for statistical data analysis by researchers especially in medical and social sciences. Textual analysis was conducted with SPAD 6.0 developed by Coheris. This software created in the 80s by a team of French researchers (Lebart and Morineau 1982), has the particularity that beyond

[7] http://www-01.ibm.com/software/analytics/spss/. Accessed 19 Sept 2012.

Table 2 Respondents' characteristics according to faculty membership, function, gender, years of doctoral degree, years as researcher and years working at UNIL

Variables	Modalities	*N*	%
Gender			
	Women	97	29
	Men	242	71
Function			
	Faculty membership (*CorpsProfs*)	156	46
	Intermediate staff (teaching or research assistant) (*CorpsInter*)	117	35
	Researchers (*Chercheurs*)	27	8
	Others (lecturer, associate member, visiting professor, substitute teacher, professor) (*Autres*)	39	12
Faculty membership			
	FBM	116	34
	DROIT	33	10
	FTSR	12	4
	FGSE	10	3
	HEC	31	9
	LETTRES	75	22
	SSP	61	18
	Common sector[a]	1	
PhD since			
	<5 years	41	12
	6–10 years	55	16
	11–15 years	43	13
	>15 years	123	36
	No answer	77	23
Works at UNIL since (seniority)			
	<5 years (*UNIL_5ans-*)	80	24
	6–10 years (*UNIL_6-10ans*)	79	23
	11–15 years (*UNIL_11-15ans*)	50	15
	>15 years (*UNIL_15ans+*)	60	18
	No answer	70	21

Abbreviations of modalities represented as illustrative elements in Fig. 1 are marked in italics

[a] Has been omitted from the study

quantitative data, it is able to analyze free text using different statistical methods on metrics related to the distribution of words in the text (frequency, distance, etc.).

Results

Quantitative analysis

The ten closed-ended questions on evaluation practices and use of bibliometric indicators were selected for analysis (Table 1, Part 2). The structure of the questions we chose is

extremely simple. Each of them asked respondents whether they practiced evaluation in concrete situations that have been proposed and whether they used to do so with the help of bibliometric indicators. Each respondent was therefore characterized by a set of ten variables with two modalities. To complete the interpretation of the results, the following additional variables were taken into account: *function, faculty membership* and *seniority* (Table 2).

The answers to the ten questions were analyzed by Multiple Correspondence Analysis (MCA), whose main elements are the 20 modalities of the ten variables concerning evaluation and bibliometric attitude. This allowed us to establish respondents "typology" according to their assessment practices. Only complete responses were considered ($n = 261$).

We limited our analysis to MCA's first factorial plane, which explains 55 % of the total variance (Fig. 1, in red are represented "no" modalities, in green "yes" modalities, and in blue illustrative elements). In modalities with a contribution greater than 3.00, axis 1 opposes "*no*" modalities of *Projet_Article*, *Projet_Mémoire*, *Projet_Fonds*, *Projet_Colloque*, *Profil_prof*, *Profil_Prix*, *Profil_Encouragement* (left) to "*yes*" modalities of the same variables (right). Axis 2 opposes "*no*" modalities of variables *BibChercheur* and *BibRevue* (bottom) to "*yes*" modalities of the same variables (above). Thus, for both axes there is a clear separation between "*yes*" and "*no*" modalities, which eases their interpretation. Axis 1 can be considered as a *Familiarity with evaluation practices*, by opposing those who say they did not

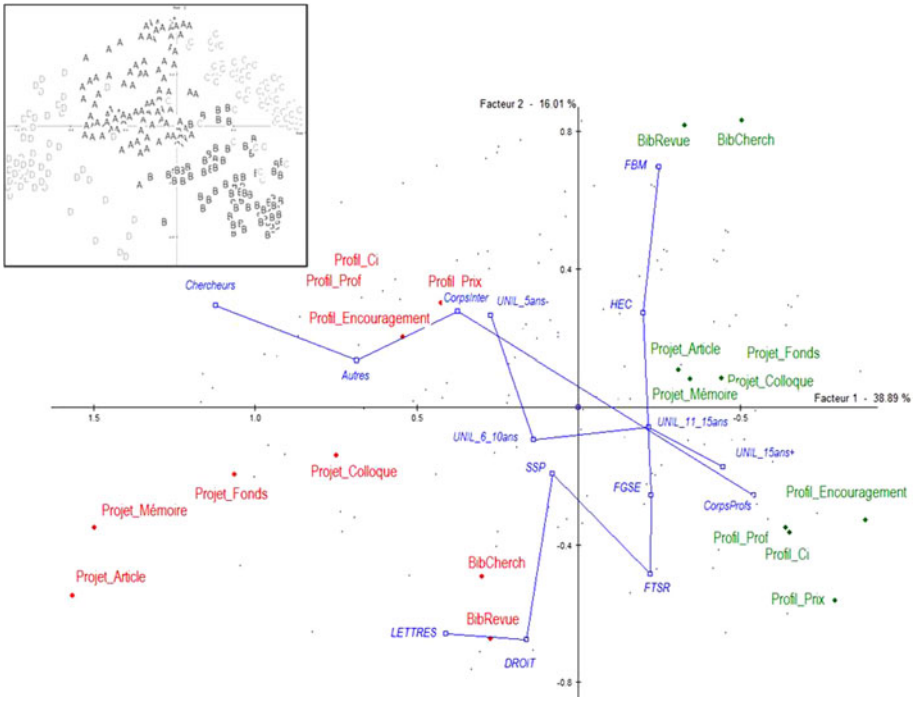

Fig. 1 Representation of the plan of first two factors. *In green* "yes" modalities; *in red* "no" modalities, *in blue* respondents' characteristics (illustrative elements). *Top left* respondents' representation according to their classes (color figure online)

Table 3 Contributions to the first two axes of the modalities of variables measuring evaluation practices and bibliometric indicator use

Modality	Axis 1	Axis 2	Modality	Axis 1	Axis 2
Profil_Prof_No	6.67	4.91	Projet_Article_No	10.35	3.11
Profil_Prof_Yes	5.68	4.18	Projet_Article_Yes	2.04	0.61
Profil_CI_No	5.81	4.39	Projet_Colloque_No	5.34	0.45
Profil_CI_Yes	5.59	4.22	Projet_Colloque_Yes	3.16	0.27
Profil_Encourage_No	4.7	1.57	Projet_Mémoire_No	10.81	1.45
Profil_Encourage_Yes	7.7	2.58	Projet_Mémoire_Yes	2.5	0.33
Profil_Prix_No	3.01	3.71	Projet_Fonds_No	9.82	0.81
Profil_Prix_Yes	5.63	6.92	Projet_Fonds_Yes	5	0.41
BibRevue_No	1.04	15.59	BibChercheur_No	1.45	9.52
BibRevue_Yes	1.25	18.89	BibChercheur_Yes	2.45	16.09

perform evaluation during their career (left) and those who say they did (right). Axis 2, which classifies respondents who do not use bibliometric indicators to evaluate a review or a researcher (below) and those who do (above), can be considered as a factor of *Familiarity with bibliometric methods*. Table 3 represents modalities' contributions to the first two axes.

The respondents' characteristics modalities (in italic on Table 2), inserted as additional elements on the first factorial plane (in blue in Fig. 1), give us some indications on the respondents' profile. Two variables are related to the first factor: *function* and *seniority* at UNIL. Thus, professors are on average in the upper right side of the figure where respondents are more familiar with assessment practices. They are also people who have worked longer at UNIL and are opposite to researchers, teaching assistants and other academic staff (left on the figure). The variable *faculty* seems to be related to both factors. We see a clear separation between FBM, HEC (top right) and Humanities, Law, SSP (bottom left). This shows that axis 1 also opposes natural and economic' sciences and social sciences and humanities. Although FGSE has few representatives among respondents, it should be located in the middle of this axis, which is in line with this faculty's double culture, shared between the natural and social sciences. The former figures on average, next to evaluation and bibliometric indicators' use, while the latter, are situated on the "non-assessment" and "non-use of bibliometric indicators" 'side. These findings make sense, assessment practices are related to academic career experience.

Respondent's typology

With a glance at Fig. 1 it is tempting to define four classes according to the four quadrants formed by the two factorial axes. In order to validate this model a *Cluster Analysis* (Ward method) was conducted. After consolidation within ten iterations, the analysis ended in four classes: A, B, C and D. The four classes that seemed to appear after the MCA are confirmed by the Cluster Analysis. Respondents' distribution according to their classes is presented in the top left of Fig. 1.

Thus, Class A, representing the majority of respondents ($n = 79$, 30 %), is characterized by general non-assessment practices concerning researchers' profile. Regarding research projects assessment, respondents in this class say they have only had the opportunity to evaluate publications, Master and PhD dissertations. This is also due to the fact that these

researchers usually belong to non-tenured staff and are relatively "new" at UNIL (working there for <5 years).

Class B ($n = 71$), with 27 % of respondents, consists of researchers that were involved in the evaluation process in all the situations described in the questionnaire: researchers' profiles (recruitment, nomination, promotion of faculty member or intermediate staff, awards or funding attribution, career encouragement), research projects assessment (reviews of articles, conference papers, funding projects). However, most of the respondents in this class declare themselves opposed to bibliometric tools' use in these situations. Some of them who have worked at UNIL for over 15 years, are "experienced" in the academic environment, belonging to social sciences disciplines (Humanities).

Class C ($n = 67$, 26 %) is characterized by bibliometric indicators' use to assess both researchers' evaluation and scientific journals review, a great familiarity with researchers' profile and research work evaluation in all situations listed. Most respondents in this class have a long academic career at UNIL (over 15 years) and belong to exact discipline (FBM) and commercial discipline (HEC). Without giving interpretative accent to sex, it is interesting to note that most of them are men.

Finally, Class D, the smallest of all four ($n = 44$, 17 %), is clearly stated as the one of non-users of bibliometric tools and those that do not practice assessment in any of the listed situations, neither concerning researcher's profile nor research projects. Belonging mostly to disciplines where research's production quantification does not make sense (Humanities), the respondents of this group are mainly young (working at UNIL for <5 years) female researchers.

One can also mention that these four classes differ according to respondents' disciplines ($\chi^2(12) = 52.09$, $p < .000$, although some number are $n < 5$). Class A is represented mainly by respondents belonging to humanities and social sciences (39 %) on the one hand, and medicine and pharmacy (37 %) on the other hand. Among Class B and D respondents, over half also come from social sciences (58 and 57 %). Class C contains mainly respondents from Medicine and Pharmacy (46 %).

Qualitative analysis: values associated with the notion of quality

The above analysis allowed us to know how researchers are situated in relation to the use of evaluation and traditional bibliometric tools. Based on this analysis, we identified four types of researcher. Now, we further study which values are associated with the quality research for each type.

To realize what researchers value in terms of research, the questionnaire began with two open-ended questions: *How would you define a good scientist in your discipline?* and *In your opinion, what is quality research?*

Since answers to these questions are complementary and often respondents write "*ditto*" to the second question, we decided to group answers and consider them as one single answer. Taking into account only previously treated complete answers ($n = 261$), most people responded to open-ended questions ($n = 245$), the distribution for the four classes is uniform.

After cleaning up (spelling and typing errors), lemmatization, suppression of "habit" words, verbs *to be* and *to have*, only words with more than five occurrences were kept. Due to the frequent repetition of expressions found in the question, words like *research* * (recherche*),[8] *quality** (qualité*), *good** (bon*) and *person** (personne*) were removed as

[8] Lemmas and generalized categories are marked with an asterisk.

Table 4 Characteristics of the answers to open-ended questions according to the four researchers' classes

Class	Before cleaning up		After cleaning up	
	Tokens	Types	Tokens	Types
A ($n = 73$)	3,528	1,108	880	194
B ($n = 68$)	3,741	1,086	957	199
C ($n = 66$)	3,064	956	819	181
D ($n = 38$)	1,701	635	391	150
Together ($n = 245$)	12,034	2,343	3,047	207

well. To maximize information contained in answers, some terms were grouped into broader categories. Thus, terms referring to bibliometric indicators like *impact factor*, *h-index*, etc. were grouped under *INDBIB**, those referring to person's name under *NOMP** and those referring to journal names under *NOMJ**. Final corpus counts 207 types which represent 3,047 tokens. Main features are presented in Table 4.

Lexical forms were crossed with the four previously defined classes with the aim of detecting *specificities*, i.e. typical answers of each class.

By examining typical vocabulary of each class, illustrated with examples of participants' individual responses, we will identify what are quality research's values for these four classes. Table 5 shows each class's most typical forms (*positive specificities*) ordered according to their value-tests. The higher the value, the more the word is specific to its class.

In Class A, we find words like *paper** (papier*), *have to** (devoir*), etc. contained in a research vision where publication is certainly important (hence the mention of bibliometric indicators importance, *INDBIB **), but a good research needs to *answer practical questions* as well (for example, often clinical questions that contribute to phenomena understanding and to practice development). For this group, mainly composed of non-tenured young researchers, high-quality research tends to be defined in terms of what it *should* ("should contribute to phenomena's understanding…", "should be innovative") and what it *should not* be ("should not reproduce what already exists", "should not be an obligation"). Also specific for this class is that researchers often refer to themselves (*I**, *we*) as a reference point ("I prefer a study that…") or as part of the quality process, because good research helps us to develop and to progress and, hence, to be able to ask even more relevant questions.

> Example 1: "Research must be published by an editor or in recognized scientific journals. Good research should also open new perspectives and propose new collaborations with other institutions."
>
> Example 2: "Research that is published in journals of a substantial impact, first. After a research on which myself and other colleagues are based because it has made a significant contribution. Normally this results in a large number of citations. That's why I think impact factor plus citation index is quite a good way to measure."
>
> Example 3: "Research that either gives consistent frameworks to a given problem, or directly proposes a specific solution."

For Class B, composed mainly of experienced researchers from disciplines where conventional bibliometrics is not directly applicable, words like *disciplinary** (disciplinaire*), *capacity** (capacité*), *source** (source*), *to articulate** (articuler*), *historical**

Table 5 List of 30 most typical words describing quality research used by respondents of the four classes

Classe A		Classe B		Classe C		Classe D	
papier*	(paper)	disciplinaire*	(disciplinary)	revue*	(journal)	pouvoir_v*	(to be able to/to can)
devoir*	(to have to)	capacité*	(capacity)	NOMJ*		sujet*	(subject)
ne*	(not)	source*	(source)	fonds*	(funds)	expérience*	(experience)
originalité*	(originality)	historique*	(historcal)	important*	(important)	texte*	(text)
ouvert*	(open)	articuler*	(to articulate)	meilleur*	(best)	transmettre*	(to transmit)
INDBIB*		logique*	(logic)	comité*	(committee)	solution*	(solution)
je*	(me, I)	état	(state)	innovant*	(innovative)	passion*	(passion)
même*	(even)	inscrire*	(to enrol at)	résultat*	(result)	projet*	(project)
nous*	(we)	théorique*	(theoretical)	international*		utile*	(useful)
répondre*	(answer)	innover*	(to innovate)	lecture	(reading)	terrain*	(field)
littérature*	(literature)	problématique*	(problem)	extérieur*	(external)	propre*	(own)
pertinence	(pertinence)	champ*	(field)	idée*	(idea)	étudier*	(to study)
argument*	(argument)	cadre*	(framework)	publier*	(to publish)	interdisciplinaire*	(interdisciplinary)
participation*		rapport*	(report)	scientifique*	(scientific)	communiquer*	(to communicate)
étude*	(study)	pensée*	(thought)	original*	(original)	acquérir*	(to acquire)
contribution*		non	(not)	clinique*	(clinical)	penser*	(to think)
esprit*	(mind)	objet*	(object)	avancer*	(to advance)	différent*	(different)
grand*	(great)	manière	(the way to do s.thing)	peer_review*		apporter*	(to bring)
rigueur*	(rigor)	hypothèse*	(hypothesis)	critère*	(criterion)	curiosité	(curiosity)
exister*	(exist)	plutôt	(rather)	publication*	(publication)	publier*	(to publish)
impact	(impact)	éviter*	(to avoid)	collègues*	(colleagues)	synthèse*	(synthesis)
clinique*	(clinical)	risque*	(risk)	obtenir*	(to obtain)	enseignement	(teaching)
questionnement*	(questioning)	approfondi*	(in depth)	conférence*	(conference)	persévérance*	(perseverance)
connaître*	(to know)	développer*	(to develop)	découverte*	(discovery)	aboutir*	(to result in)
ouverture	(opening)	synthèse*	(synthesis)	article*	(article)	thématique*	(theme)
maîtrise*	(master)	empirique*	(empirical)	développer*	(to develop)	réseau*	(network)
nombre	(number)	travailler*	(to work)	fondamental*	(fundamental)	travailler*	(to work)
savoir_n*	(to know)	connaissance*	(knowledge)	base*	(basis)	ancrage*	(anchor)
mener*	(to lead)	intellectuel*	(intellectual)	clair*	(clear)	académique*	(academic)
façon*	(the way to do s.thing)	fort*	(strong)	réponse*	(response)	plusieurs	(several)

Lemmas and generalized categories are marked with an asterisk. An English version is in brackets when necessary

(historique*), etc. are typical. The members of this class rightly insist on their discipline particularities and, for them, quality research depends heavily on researcher's ability, on his/her "working capacity", "thinking skills" and "language skills". In their view, quality research stimulates thinking, it is part of *solid theoretical* and reflexive frameworks, it changes the way a phenomenon, a historical event or text is perceived. In this vision, a research studies in depth unexplored sources or develops problems likely to complete unresolved issues. For these scholars, expressing research performance in quantitative terms does not make sense because, above all, "*it is the intellectual adventure*" that is the most rewarding.

> Example 4: "Main virtues seem to be curiosity, theoretical inventiveness, rigor and it is characterized by a happy synthesis between (1) the "fieldwork": relevant constitution of research corpus, knowledge of question's status and (2) rigorous theoretical and methodological reflection, conducted with logic, whatever the theoretical field."
> Example 5: "A research based on innovative issues, articulated with a good expertise of historiographical statements of knowledge and a critical and rigorous analysis of sources."

Words like *journal** (revue*), *NOMJ**, *funds* (fonds), *best** (meilleur*), *committee** (comité*), etc. are most typical for Class C. It is easily possible to guess quality research values shared by respondents in this class. Publication of original work in top international journals with peer-review, focus on some renowned journals, "to generate peer-reviewed funds", appropriate dissemination of empirical results—characterize quality research in this class.

> Example 6: "Research that generated peer-reviewed funds and that is published in quality journals."
> Example 7: "Criterion 1: number of articles in international peer-reviewed journals, weighted by journal's quality. Criterion 2: number of citations (according to Web of Knowledge, not according to Google Scholar). Criterion 3: books or chapters, weighted by publishing quality, an article published in prestigious journal and/or citation frequency."
> Example 8: "Publications in type A journals, and also in the best specialized journals."

Finally, typical vocabulary that describes research quality in Class D contains *to be able to*/can** (pouvoir_v*), *subject* (sujet), *experience*, *to transmit** (transmettre*), *solution**, *passion**, etc. Firstly, quality research is research that *can be done* with passion, where one *can* (and not *must*) publish after some experience, it is not an obligation. This would be a well detailed research on a current subject that offers real solutions to real problems; it's a fieldwork research, with results also understandable and useful to large public and which are not necessarily aimed to be published. This class mentions *teaching* (enseignement) as an important element in research, because a good research serves to transmit and communicate results, knowledge, both within academic and non-academic world, it is a research that can be taught.

> Example 10: "Consistent theoretical and methodological basis, scientific validity criteria reached, research inserted in society: have a little bit of utility for non-academics."
> Example 11: "A thorough research on a current subject that offers concrete solutions to concrete problems."

Example 12: "A research where one has time to do experiments properly and where one has the right to make mistakes and not a research that one has to publish before it's too late and before one ends up unemployed."

To summarize, however limited in words, our corpus allows drawing typical "portraits" of respondent's answers on what they mean by quality research. Yet, it is important to note that given the expressions which served as basis for our analysis come from participants' everyday language, their interpretation should be considered as an approximation of the reality. Although some refer to concepts that have scientometric connotations (*impact*, *indicators*, *citations*) very few really do. For example, in any assessment procedure based on quantitative tools, selection and definition of indicators is essential (Vinkler 2010). In our sample, among the few that mention indicators, the majority imply only impact factors (mostly in Class A). Often misspelled, very few participants are clear what indicators actually measure, it is also one of the reasons for which we considered more appropriate to tag them by the lemma *INDBIB**. Other example we can mention is the use of the term *impact*. From scientometric viewpoint *impact* may be characterized by papers' mean citedness (Vinkler 1997). For most of the respondents, the term *impact* is synonymous with influence, research's contribution to theory or practice.

In addition, it is important to mention a relationship of dependency between belonging to one of the four classes and the use of bibliometric indicators during assessment procedures[9] (journal's evaluation: $\chi^2(3) = 85.87$, $p < 0.000$; researcher's evaluation: $\chi^2(3) = 158.86$, $p < 0.000$). Excepting Class C, researchers do not use quantitative tools in these situations. This is particularly striking for Class B where negative responses regarding the use of quantitative indicators to evaluate a review ($\chi^2(1) = 10.23$, $p < 0.000$) or to assess researcher's profile ($\chi^2(1) = 14.59$, $p < 0.000$) were significantly higher than expected values. Only in Class C, where quality is defined referring to quantity, the fact that respondents affirm they use bibliometric indicators for both journal and researcher's profile assessment is significantly higher than by the random hypothesis (respectively $\chi^2(1) = 30.68$, $p < 0.000$; $\chi^2(1) = 66.92$, $p < 0.000$).

Discussion

Immersed in a competitive environment, influenced by the current emphasis on evaluation, universities are required to increase the visibility of their scientific activities. This push for enhancing visibility, stimulated by the proliferation of various world rankings systems for universities, favors the choice of quantitative indicators to measure the *value* of scientific production. To be comparable, researchers transform their performance, their scientific production, into numbers, and attempt to quantify and measure research *quality* by adopting a single representation of it. However, the definition of research can be based on multiple *values*.

The purpose of this study is to illustrate the diversity of these values in the case of a Swiss university (UNIL), through a fine analysis researchers' current vision. A multitude of questions concerning this vision are addressed here. What are researchers' assessment practices in terms of scientific production? To what extent do researchers give importance to quantitative, bibliometric criteria to assess scientific production? What is their position in relation to bibliometric indicators quantification and use? And, finally, what is their representation of quality research underlying *values*?

[9] See Table 1, last two questions.

To amplify the emergence of values corresponding to representations of quality research, we adopted a bottom-up approach. This way, researchers are characterized directly by their own answers (Cluster Analysis) and not by a prior categorization due to disciplinary or professional affiliation. Qualitative analysis of answers to open-ended questions, preferred here to conventional content analysis, has the advantage of diminishing to a maximum the unavoidable subjectivity coming through responses interpretation. Here, answers are treated without prior allocation into categories, and reflects the "natural" context of a word occurrence.

Four classes of researchers emerge from the analysis. Three of them, each representing about a third of the respondents, indicate three types of "quality values". "Youngest" researchers (Class A), consider research as a civic duty, where publication is mandatory, but, in the mean time, that "real" research values are to provide solutions to problems. The other two groups of "experienced" researchers represent quality values almost in an opposite way: one of them favors the "purely intellectual adventure" of research at the expense of research publications (Class B), while the other highlights publication numbers in top international journals, as one of the key points of quality research (Class C).

The fourth class (Class D), representing the smallest group in our sample, consisting of researchers who are rather new in the academic career, is a somewhat special. They are less likely to mention research activity as such, but rather the activities associated with it, like knowledge transmission and communication to scientific or non-scientific public, research results transfer to teaching, etc. This point opens the perspective to consider the use of current research in education as valorization tool for the university.

The questions about research quality—get a wide range of answers. Regardless of the fact that the concept of "research" has been clearly specified in the question, many respondents describe a rather broad scientific activity, which is not limited necessarily to research. The four classes of researchers represent four different science areas, namely the vision of research as a "solution to a problem" (A), as an "intellectual challenge" (B), as "determinant factor on rankings" (C), as "knowledge transfer" (D). Embracing values linked directly or indirectly to quality research, the four clusters could be arranged on a continuum ranging from values close to research activity as aim (Class A) to those which globally accompany it as an environment (Class D).

The typology we build has some common characteristics with other European universities. Making a parallel with Swedish researchers' representations studied by Hemlin and Montgomery (1990) and Hemlin (1993), Class A would focus on *intra-* and *extra-scientific effects* (e.g.: discipline or research program contribution to knowledge, remedies for cancer, achieving a tolerable life in developing countries, etc.). In Class B, we recognize the hemlinien third factor, namely, skills relating to the *researcher* himself, to his/her personality, and intelligence. In reading Class C responses, we recognize the first factor's characteristics such as *objective indicators* and *funding* (factor 7). Finally, Class D seems to have the characteristics of factor 5, *intra-* and *extra-scientific effects*, the factor 2, *research effort* and the factor 6, *research policy*.

Returning to our first two questions that have initially guided our study we note that only a quarter of respondents are familiar with bibliometric approaches and with their utilization for evaluation purposes. Thus, it is interesting to note that those who define research "excellence" in "quantitative" way are in minority. In scientometric terms it would be interesting to know to what extent representations of research quality are influenced by publications' quantity and/or impact. In our research only in Class C we seem to observe this influence. The contrast is particularly striking with Class B, which almost seems to be negatively influenced by scientometric tools tending to "refuse" their use.

For most scholars in our sample, focusing only on measurable aspects of "excellence" would be simplistic and would neglect other values that accompany a research activity. We note that experienced researchers are mostly practiced in research assessment, and are associated with a rather "quantitative" mentality. This raises the question of finding what could cause this behavior? Is it due to researchers' generation factor, to the spirit of the times to career development? It would be interesting to see how the situation evolves over time.

If we refer to Lamont (2009), quality is one of the criteria of an excellent work. However, as our study shows, the concept of quality in itself may not be a criterion because it is already bearing its intrinsic values. Probably many disagreements on research evaluation by peer-reviews, even those concerning epistemological foundations of a scientific work, correspond to different implicit values associated to quality research (Mallard et al. 2009). Our study makes explicit scholar's implicit values on which they base research quality definition. All respondents agree on the notion of quality, but not all of them agree on the values that are attached to it, because quality is a value-loaded concept.

Thus, the faculty, the department or the team who have to evaluate the quality of research must first clarify the specific values associated with it. Only once this step done, can we decide how to assess, measure in a consistent way, because "quality indicators" should be congruent with the underlying value system.

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Appendix: Questionnaire used for the study

Q1. How would you define a good scientist in your field of discipline?
Q2. According to you, what a quality research in your field of discipline?
Q3. Have you ever had the opportunity to assess researchers in the following procedures/situations:
(a) Appointment or promotion of a faculty member
(b) Appointment or promotion of an intermediate staff member
(c) Decisions of funding someone in order to encourage an academic career
(d) Awarding of a prize or distinction

Q4. Have you ever had the opportunity to evaluate research papers or projects (e.g. scientific articles, conference papers, dissertations degrees, funding projects, etc.) in the following procedures/situations:
(a) Revising journal article, a book, a book chapter for publication
(b) Preliminary assessment or public criticism of a symposium or conference
(c) Evaluation and grading of a bachelor's or master's thesis or a PhD dissertation
(d) Research project assessment related to request for funding

Q5. Do you use bibliometric indicators to assess a scientific journal?
Q6. Do you use bibliometric indicators to assess researcher's profile?

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