Review

Assessing excellence

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INTRODUCTION

This document addresses one of the most delicate and long debated issues in scientific research, i.e. assessing excellence. Indeed, the actions undertaken by organisations in different nations underline its great importance.

Assessing excellence is one of the aspects to be reconsidered in view of the changes that have taken place in the world of science over the last decades. Today persons belonging to both genders have to be assessed using new parameters that consider female specificities and include them to achieve successful scientific endeavours. Innovating assessment also means encouraging the new generations to look favourably at science and technological disciplines and include them in their professional experiences. This aspect is of major importance for the future of nations (see special issue of Euro scientist, Jan. 2014).

If modern society needs greater involvement of populations in scientific issues in terms of being able to make decisions regarding very delicate topics impacting on the future, it seems crucial to construct suitable capacities and professionalism able to provide qualified contributions for knowledge (that I would not restrict to the technological aspects, but include also humanistic ones).

This document carries on from the previous one proposed in the framework of the Genislab project on stereotypes (*Breaking the vicious cycle of gender stereotypes and science,* Francesca Molfino and Flavia Zucco, 2012). It surfaced within the project and was based on a problem reported by almost all the scientific partners (Italy, Germany, Serbia, Slovenia, and Spain, with the exception of Sweden). Its aim is to provide fundamental information on factors determining the need to change how excellence is assessed, on the meaning of excellence, and on the implementation of more adequate and widely acceptable procedures.

The documents also provides some fundamental reference elements to attain assessment that not only advances the knowledge required for science today, but, in particular, stresses the importance of women's knowledge as a necessary strength to achieve successful research and further knowledge. In reality, women have not been able to express their capacities and talents, especially at managerial level, because of exclusion policies and the stereotype prejudices.

Why adopt exclusion mechanisms?

Knowledge is power: the bible (the theft of the forbidden fruit from the tree of knowledge) and the Greek myths (Prometheus stealing the sacred fire) clearly show that knowledge belongs to the gods, and anyone stealing it will be punished harshly.

Academia is a seat of power and internal figures with decisional powers decide its resources.

Over the years, knowledge organisations have been created to respond to the requisites of the conquest of knowledge, but also to keep knowledge in the hands of those inhabiting such places.

Is there any other way to explain why women were excluded from knowledge, why women attempting to attain it were banned or made invisible?

The changing times have partially wiped out some of these mechanisms, but left some hidden in the folds of the organisations. And thanks to some existing and pervasive stereotypes, others have been invented.
Exclusion mechanisms are summed up below:

- lack of transparency and objectivity in assessment procedures;
- decision-making powers often lie in inappropriate seats of power (political, professional, social);
- trans disciplinary sectors are considered of marginal importance;
- scientific production is not assessed in relation to resources available;
- there is a gender bias towards men (male quotas) that is not based on meritocracy.

Factors influencing exclusion: *(focal points of the discussion on excellence)*

- gender (female invisibility);
- belonging to schools, networks, etc.;
- criteria set by men and based on institutional models created by them (peer evaluation);
- ideological and cognitive type stereotypes (the former being easier to fight)[1];
- Homosociability (Homosociability is defined as the fact that people feel more comfortable in the presence of others who are like themselves.)
- Standpoint bias
- Gatekeeping
- Co-optation
- Honors[2]. Honor is an important component in the production of excellence.

[1] Studies of social cognition have shown that **individuals have powerful tendencies to perceive and interpret people and events in terms that confirm their prior expectations and concerns.**
[2] *Awarded by the peers; you must enter into a network of exchange of honors with their peers. The position of men and women with respect to honor is different, i.e. honor is a gendered construct. Modeling scientific interactions as interactions that aim to obtain scientific honor, and coupling it with the concepts of the honor code (fighting against a woman does not bring honor, and defeat in a match with a woman implies a greater loss of honor than a defeat in a match with a man) may explain why women are not as integrated as men in scientific networks. The pursuit of honor is one of the factors that produce homosociability.*

SOME OF THE METHODOLOGIES ADOPTED

In scientific research excellence is assessed by different giving scores to individuals, or to departments, universities, bodies and nations. It must be pointed out that the following analysis and proposals are limited to individuals, their scientific qualities and, as shall be seen, also their behavioural capacities. Indeed, we are interested in this level as it has played a major role in excluding women from decision-making positions in scientific research and has thus cut their career short.

Assessing individuals varies depending on their level (fellow, researcher, first researcher, head researcher) or other roles (member of commissions, of projects, editorial boards, or other leadership roles).

We do not deem it necessary to discuss all the articulations here, yet adjustments to all the criteria are required as indicated by the remarks on guidelines.

In addition, there are degrees of flexibility linked to single disciplines and organisations that, from time to time, can call for appropriate changes to meet particular needs.

When assessing humanistic disciplines, one is trying to make such evaluation more solid and homogeneous, redefining the areas of pertinence. At the same time this specific area of knowledge will benefit from re-dimensioning pure objectivity in terms of numerical quantification (sic!) that up to now has underpinned the assessment of scientific technological disciplines. As we shall see, the approach is becoming more flexible and comprehensive. It is functional to contemporary science and particularly positive for gender issues that we believe are the focal point.

1. EXCELLENCE

The word excellent should be used with great care, especially in scientific fields where the pertinence and obviousness of its meaning are part and parcel of typical scientific conceptual rigour.

The word excellent can be referred to persons or things, it indicates ones having above normal standards that are perfect according to predefined criteria related to the field the concept is applied to.

Hence, the drive for excellence can be a used to promote highly qualified activity and master particular capacities, yet at the same time it can cause discouragement and exclusion. In reality, the daring required to achieve perfection does not motivate persons who have a measure of normality, or for objective conditions, do not feel able to drive themselves in this direction.

Indeed, in Denis Diderot's famous writing **"Rameau's nephew"** the philosopher says that if everyone were excellent, there would not be such thing as excellence.

Therefore the ambiguity of such definition that conjures up ideas of uniqueness alongside lofty criteria is clear: not all persons, by definition, can be excellent, and women have difficulty in being recognized as excellent and recognizing themselves as such.

This situation is comprehensively and clearly documented in the ***Topic report: Gender and Scientific Excellence,*** (by Elisabetta Addis with the assistance of Costanza Pagnini) after examining the literature surveyed in the ***Meta-analysis of gender and science research*** project**.**

According to the authors, "*The definition of scientific excellence is elusive (The scientific community acts as if excellence were an obvious quality, and seldom feels the need to define it clearly. It defines it clearly only within a scope of a specific discipline (e.g. medicine), which does not help to explain why women scientists encounter difficulties in achieving excellence across discipline……. In the literature, rather than positive definitions of scientific excellence, one usually finds a set of circular references between the concept of scientific excellence and the criteria used to define it".*

Nonetheless, the authors propose a definition deduced from the documents examined: **"***Scientific excellence is the ability of a scientist or an institution to impact on a field of study producing a major change, leading other scientists towards asking new questions and producing new, important and useful contributions to knowledge, using new methodologies. The quality of excellence must be proven by a number of means, (such as publications, citations, funding, and students) and recognized by the peers by the bestowing of various honors, prizes and other awards".*

Along with all this, a critical point should be taken into account**:** "……***the pursuit of excellence was described by many participants as a set of practices framed within a 'discourse',*** *used by the scientific community to organize its self-governance [...].The discourse about what characterizes excellence is generally not subject to scientific evaluation, and the actual practices in each branch of science are often quite idiosyncratic.* ***It is assumed that the scientist in each field somehow acquires, from his or her environment, a notion of what excellence*** *is, and that there is no need for a critical evaluation of the concept and of its correspondence with actual practices. There is a*

dominant characterization [of excellence] the one adopted in the natural sciences, which produced standards that have been easy to adopt more generally but has been criticized as rather limited and prone to reductionism".

According to Ana Proykova, member of the previous EPWS Committee, (Faculty of Physics– Sofia University, Bulgaria), "*excellence is not a status. It is a process of development, achievements of goals that defies old limits and* ***maps*** *new territories".* She stated her point at an EPWS meeting in Maastricht at the WISER festival dedicated to the concept of excellence in October 2007.

Her definition is surprisingly in line with the ideas postulated by Sheila Rowbotham, a well-known feminist active in the early years of the movement. According to her, "*Experience-knowing is characterized by symbol, myth, allegory. The dominated can tell stories, they can fantasize, they can create Utopia, but they cannot devise the means of getting there. They cannot make use of* ***maps****, plan out the route and calculate the odds. The dominators continue to hold ideology. Thus while the traditional woman is able to defend herself, she is unable to create the conditions which will make such defense unnecessary"* (*Women's Liberation & the New Politics, 1969).*

Hence, it is clear that the concept of excellence in practice presents ambiguities resulting from possible interpretations and the approaches adopted to define it. The structural changes affecting science and the new figures addressing it, both men and women, require a new constructive definition responding to the latest contexts and up-and-coming needs.

Accordingly, the concept of excellence has to be opened up and modernized to allow women to enter science safely and successfully, and contribute to knowledge advancement and innovation.

As I shall explain later, I believe that the concept can only be legitimately used if one accepts a competitive society, for research groups and organizations, but not for individuals.

Information on excellence can be obtained in the documents produced by the European Commission in the framework of projects it financed (Gender and excellence in the making. EU Commission, Directorate general for research, 2004; Gender and scientific excellence, Topic Report of the project *The meta-analysis of gender and scientific research, 2011).*

2. STRUCTURE OF CONTEMPORARY SCIENCE

The new path science has trodden as from the second half of the twentieth century has to be contextualised in order to address excellence.

Institutionalisation of research has made it a state-funded activity regulated by collective labour contracts. Thus, the director of an institute is a state manager with partly standardised rules regulating the organisation of labour. The manager's activity is contingent on state directives and financial support. Clearly, this has changed, among other things, the symbolic icons regarding science and scientists that have prevailed in

Europe since the seventeenth century. Scientists are no longer isolated in their ivory towers, nor are they absolutely free from constrains and guided by pure geniality (admitted that this was really true in the past). Structuration of science in contemporary society has determined two-way ties of public tasks and responsibilities that have radically changed science.

The scenario is somewhat different in the USA where the competition driven private sector prevails. Industrial research constrains are even greater, indeed just think of predefined goals, confidentiality and patents. Yet the debate on excellence and assessing excellence is not that different to the one in Europe.

A profile of the traditional representation of science can be found in R. Merton's *The Sociology of Science, Chicago University Press, Chicago 1973,* J. Ziman's book *Real science: what it is and what it means. Cambridge University Press 2000* and L. Gibbons et al's. *The new production of knowledge. The Dynamics of science and research in the contemporary societies, London, Sage, 1994*) on the relative transformations that occurred during the second half of the twentieth century. Some of the points explaining the enormity and features of this change will be summed up later.

2.1. TECNOLOGY

According to K. Kelly, the dominating aspect of science today (*The third culture, 1998. Science 279, 992-3*) is technology that is destined to produce innovations that can be successfully marketed. She states that: "the prevailing push is not to search for the truth but for innovation. The chosen best way to operate is production more than creativity. New tools are created quicker than new theories. Science creates knowledge, technology creates opportunities".

In this way procedures prevail over theory and the strong relations with the market have determined a certain proletarisation of research due to competition and the ensuing acceleration of production. Debates in *Science* and *Nature* and other scientific journals have discussed how some projects (e.g. the genome project) made the operators carry out repetitive and intensive actions, constrained them to machines and lose their vision of the overall structure of the project itself (despite the training of "brains" and the selection of talented people).

Moreover, titles of scientific papers have become assertive (indeed promotional like in advertising), publications have been withdrawn by journals (due to non corroboration of data), and cases of fraud or misconduct have occurred (e.g. the well-known case of the Nobel prize winner D. Baltimore and his PhD).

2.2. SOCIAL AND ETHICAL IMPLICATIONS

The prevalence of technological aspects has created problems within the scientific world and is also impacting on how society thinks, in particular the political community that regulates and organises it.

The important and disputed Italian philosopher, Emanuele Severino, is considered an anti-scientist who has effectively shown the risks these changes to science determine on scientific thought itself and the long-standing consolidated epistemological culture (*La filosofia futura, Rizzoli, 1989*). According to him, *without technic you cannot reach the aim thus technic becomes the real aim.*

It is a question of doing what one does only because one can? That one does not ponder over the goal anymore? Indeed, as R. Levi Montalcini once said, not all that one can do has to be necessarily done.

According to Severino notion of truth isn't related to Nature's design but it finds itself substituted by the concept of efficacy. Technical activity will offer the truth in terms of efficacy. Science has been structured in codified knowledge while technic is a continuous production of new ideas to be verified and eliminated without loosing value. Even perception of living in the technical era leads to see the world as a container of utilities.

At this point Heidegger would add that the world passes from landscape to reserve: it is a deposit of availability. Technic proposes a fragmented, accelerated time that continually dislocates its recent past and immediate future.

G. Anders (*L'uomo è antiquato 2007, Bollati Boringhieri, Torino*) analyses the social and cultural implications of such change in greater detail. He states that technology not only provides new tools, but also legitimates new behavioural patterns, institutional balance, cultural processes, that are not subject to the verification of legitimacy as they are "neutral" products of reason.

In effect, the changes in science have impacted almost inevitably on theoretical, ethical and social issues, and I shall provide examples to illustrate some aspects of each.

Theoretical issues. There has been an pompous abdication of the processes of science that involve the formulation of hypotheses, experimental verification of the same and following validation (or rejection) depending on the experimentation results. Today, as technology provides new potentials, data are collected, and processes and feasibility studies are formulated afterwards. The leading example is the genome project that at its outset sparked a debate on exactly this novel approach.

Ethical issues. Science has been shouldered with a series of compatibility requirements regarding the consolidated values of various peoples' cultures that used to be outwith the normal moral confines of science. The latter essentially having to respond solely to the principle of objectivity in scientific observation.

It is meaningful that in his book (*L'uomo nell'era della tecnica. Armando Editore, 2003*) A. Gehlen states that the ethic role is confined to be as a sentinel of technic evaluating efficacy, feasibility and functionality. Ethic has essentially to handle a sort of chronicle "alarm state" raised by technical innovations.

Social issues. Sociologically, science and the advancement of knowledge have changed dramatically. It is no longer merely a question of studying, experimenting, understanding, discovering, nor is it a question of being the guardians of the ivory tower. Indeed, in 1973 Robert K. Merton, the first philosopher of science, clearly showed that *"the **fourth major role** or function of scientists, in addition to those of researcher, teacher, administrator and gate-keeper is to evaluate the promise and limitations of aspirants to new positions, thus affecting the mobility of individual scientists and, in the aggregate, the distribution of personnel throughout the system".*

Science is disseminated from the Olympus to the *agora* with all the implications that are evident to all (Helga Nowotny, Michael Gibbon and Peter Scott, *Re-Thinking Science, 2001*).

The table (Annex 1) lists the number and type of daily tasks researchers have to carry, obviously not all at the same time, in the three different career levels.

CONCLUSION 1

It is evident that the concept of excellence immediately clashes with the possibility that a single person possesses all these capacities concomitantly and expresses them to the highest degree. On the other hand, it is known that really talented people, excellent minds in the scientific field, are often not so proficient in other areas, in particular they lack organisational and administrative capacities, or have difficulty relating to others. The thirty-year-old Francis Crick was about to be barred from his PhD course when he met Jimmy Watson and the two of them went on to be the co-discoverers of the structure of the DNA molecule. This is one of the many stories that reveal how science takes unexpected turns and is influenced by individual experiences of the various giants in science. This helps us understand the conditions and degrees of freedom required to ensure potential talents are fostered and brought to the fore.

3. CHARACTERISTICS OF EXCELLENCE IN THE NEW CONTEXT

At this point it is clear that new capacities are required and that the system of scientific research works. Because of its complex structure, it requires diversified capacities and talents on one side and more flexible individual attitudes on the other. Such produce optimal integration of activities that then creates a **group** of excellence. It is rather like an orchestra where everything works to perfection and all the musicians perform efficiently. In the arena of science, competition must be replaced by cooperation/collaboration, attainment of power (position and amount of resources that should not be considered as personal prestige) must be flanked by accountability towards the organisations one belongs to and to the community one is accountable to. And this encompasses research results, as well as their technical, cultural, philosophical and ethical implications.

Individuals' single capacities and competencies have to be exercised so that all can express themselves to the full. Indeed these two factors underpin the noteworthy recent considerations made by M. Nussbaun and A. Sen (The quality of life, 1993). These have to be assessed according to the criteria of merit and not excellence; indeed the former encompasses and enhances individual capacities in a specific context and have to be fostered in the young who have to be given the time, space and resources to express their talents. Capacities are to be understood as the heritage of each individual's attitudes, culture, and context they grew up in, whereas competencies are represented by everything learnt during education or work experiences. It is evident that they are interwoven. Diversely, excellence is a universal absolute linked to many loosely defined areas (science, sport, art, etc.) and is devoid of other qualities, thus opening numerous interpretations.

A previous document (Bice Fubini and Flavia Zucco, 2000, Roma) analysed the assessment of merit, particularly focusing on gender. Some considerations can still be used to understand the enormity of the actions to be undertaken.

3.1. BELONGING

The concept of belonging involves a code of "rules", such as belonging to the same research group (academic family, "school"), the same football club, being a member of the Rotary or the Freemasonry. In other words it is a case of being part of "old boys' network".

It is not difficult to understand that women, weak actors par excellence, are at a disadvantage in this "belonging to a group" system. Indeed, there have never been female equivalents of these networks, a fact that women are rightly proud of and consider a point of honour. When the criterion of belonging (i.e. a case of *who you are* and not *what you are*) becomes standard practice, and as a result the best are not selected, the "weak actors" feel personally offended even if they are not directly involved in the decision. And this leads to discouragement, humiliation and self-exclusion. Such practice only favours skilled self-promoters who accept and embody the old boys' network" system, and hence replicate the practice. It must be underlined that these privileged "clubs" do not coincide with institutional arenas but represent real and proper centres wielding (covert) clout. Making sure that decisions and rules are once more taken and decided in the appropriate institutional arenas is one of the ways to combat the practice of selecting those who "belong".

3.2. MERIT

"If you work well, sooner or later you are rewarded". This mind-set often referred to as typically female, is a losing approach, unless **meritocracy** comes back to the fore. The meritocracy approach, whereby people are assessed on their merit and research projects evaluated on their scientific value, would be both trivial and subversive. Meritocracy would become even more relevant in a new university environment where assessment is extended to various organisations and levels. The advantages of pursuing the meritocracy-based approach right from recruitment are self-evident, indeed one is able to develop one's potential and climb up the career ladder, both at one's workplace and in other universities and research centres.

Since recruitment and training run through many term positions, the assurance that good work, exacting in the case of research, will be recognized, must be guaranteed. Undeniably, in this era of job insecurity, women who have to juggle career and family are demoralised when vacant positions are unjustly occupied by the "more powerful" after these women have unwaveringly devoted themselves to their research. This becomes a standard system that swells the ranks of the powerful and progressively wipes out small and/or anomalous groups where most women are confined. Not only, in the field of research it results in, with few exceptions, the scarce presence of women in decision-making positions, expert commissions, in other words in top positions. And this in turn means that young women entering into the world of research do not have "role models" to refer to.

The issue of demands then takes the floor: more decision-making positions for women or a drastic shake up of the way the world of science is organised? In order to ensure that one or the other gaol is achieved, the recognition of prevalently female traits, i.e. gender parameters, has to be introduced in the **assessment process**. Without aspiring to extend them correctly and exhaustively to other disciplines, one can start by highlighting some positive traits regarding research that, to date, are more common in women than men:

- valuing interdisciplinary research. Up to now such research has been systematically marginalised, even if it is a powerful drive for knowledge for those involved and indicates curiosity and talent that should be fostered;
- performing coordinating roles with the spirit of service and not as a everlasting power and honour. In other words pragmatically pursuing results rather than self promotion;
- dedicating oneself to training, not only with regards to teaching and research activities, but focused on training future generations who will step into today's researchers' shoes. The well known notion "*Après moi, le déluge*" is typically male and prevails in, and jeopardises, our organisations;
- paying attention to appropriate times, funds and ways of performing research geared at research itself, and not at self-promoting to the detriment of the other persons involved in the project;
- striving to organise one's work and fostering collaboration rather than engaging in traditional competition.

Assessment parameters reveal that these features have to be correctly identified as they are often overlooked in merit-based selection. These parameters are time-consuming and so have to be able to assess both qualitative and quantitative value correctly.

According to NSF 2006, more capacities have to be added to those already required for scientific research. Indeed, they must encompass *assertiveness and single mindedness,* motivation, curiosity, dedication, flexibility and diplomacy. The new context reveals that the integration of individual diversity and interdisciplinarity promote group, and thus also individual, excellence. Science often utilises theoretical tools and machines are often centralised, calling for professional interfacing and cooperation that foster the coming together of different knowledge, competences and personalities.

In 2010 CERN adopted a ***competency model*** that includes a list of required behavioural traits alongside the professional profile for human resources. Here are two important items taken from a long detailed list:

Self-management. Individuals show perseverance/determination and take the initiative. They have realistic confidence of their own capacities. They understand their emotions and are aware of how they impact on behaviour. They manage pressure efficiently and misunderstandings successfully.
Helps others to give their best. Individuals create teams of different and valid members. They teach and encourage human resources to achieve goals in line with those of the organisation. They empower human resources as they develop. They build a culture of team spirit and collaboration.

This list together with the detailed list of professional scientific and technical requisites clearly shows the importance of individuals' behavioural traits in achieving success in contemporary scientific activity, and also underlines the radical change as regards the past. It highlights that the crucial factor is creating honest integration within a group and around a project/idea.

It is therefore a question of adopting criteria that assess *soft capacities*, as well as strictly scientific *hard capacities* since both sets have the same specific weight and impact in the contemporary world of science. Today, in fact, it is no longer merely a question of selecting the best individuals from an absolute and restrictive scientific viewpoint, but of selecting those most suitable for the research organization.

It is acknowledged that women working in research prevalently possess these characteristics. Not only do female researchers hold top positions in their own disciplines, complying with the criterion of capacities and competencies, they also have the afore-mentioned added qualities. Therefore, they are an enormous resource for contemporary science. According to the 1991 Nobel prize-winner for physics Pierre-Gilles de Gennes, women are able to build teams. They know how to train students while giving them reign to express their potential, and above all they are able to curb their own ego (interview given in 2005).
But women have other qualities that are emerging in research activity. The fact they are neophytes leads them to indulge in the enthusiasm and curiosity that "research for innovation" seems to have smothered. Numerous studies have revealed that women have a holistic vision of things allowing them to pay more attention to the intriguing

boundaries between disciplines and making them more flexible regarding their interests and roles.
Women researchers appear more responsible when performing their tasks in the world of science and in society. They are attentive and efficient when managing the resources of the organisation, they do not shun confrontation and debates, and they often take initiatives in training and disseminating scientific information to the public.

Claudie Haignere', member of the 2007 Descartes jury awarding the prize for excellence in scientific research, said that *"Women have their own qualities, their differences…they have to keep their specificity…..they don't have to enter a masculine mould…."*

CONCLUSION 2

Contemporary science requires all the wide range of individual attitudes involving capacities and competencies be fostered and enhanced, e.g. from the ability of abstraction to the moral sensitivity for the results of one's work. It requires an overarching vision of the meaning of one's scientific research as well as mental open-mindedness allowing one to connect to other areas of science and enter into debate with society.

Currently, women seem more gifted in this field than their male colleagues. Perhaps it is the right moment to insist on positive models (since they are useful, simple messages to orientate oneself in a context that deserves attention). This is described in greater detail in the previous document *Breaking the vicious cycle of gender stereotypes and science,* Francesca Molfino and Flavia Zucco, 2012.

4. ASSESSMENT

Assessment of individuals is required in the field of scientific research if the aim is to train, recruit and promote a good number of high quality persons. The lack of transparency and homogeneity in assessment procedures is criticised by the scientific community, and not only by those who have been penalised by such processes (women, ethnic minorities, those coming from not particularly well known universities and research centres).

Concerning **transparency**, Silvana Vallerga (Consiglio Nazionale delle Ricerche, Italy / Imperial College London, UK & Helsinki Group on Women and Science) proposed *The*

Minerva Code (www.old.enea.it/cpo/Approfondimenti/Minervacode.pdf) that is a model for the interpretation of the European Charter and Code for Researchers. The code provides that *calls* be published two months two months in advance and that all the assessment criteria be published together with the tasks of the related position, that all the Committee members', plus the candidates', CVs be visible, and that all the winners be listed and their CVs published and available to all.
It was thought that the groundswell that had driven the twentieth century would have promoted objective scores to achieve such goals. Way back in 1960 Eugene Garfield founded the Institute for Scientific Information that over time proposed and perfected two scores systems of individuals' scientific worth. Indeed, impact factor (IF) and citation index (CI) were mathematical and objective methods to assess scientific publications and were widely accepted by the scientific community. For more information, see the ESF document *"Consensus conference on the theory and practice of research assessment, Capri, October 1996"* (ESF 1998). This document also reports the limitations of such scores in the intent to improve the tools. It has to be pointed out that, as expected, there were only three women in the hundreds of participants, these women being the secretary, the person organising the meeting and the ESF secretary!
The limitations were never eliminated over the years and the score systems have been widely criticised. Recently, they have appeared even more inadequate, or only partially useful, in evaluating a more complex process of assessment. A paper written for "Sistema Ricerca" a periodic magazine of the Italian Research Trade Union summed up the weak points of such assessment system.

Over the years some of the assumed problems became evident and yet others emerged. For example, think of the more and more numerous cases of retraction of publications due to non- confirmation of data, caused by excessive competition. This has embarrassed the editors of scientific publications and the peer review system. The real problem is that, although the articles have been retracted, **they are still quoted** as the retraction is generally limited to a short announcement in the last pages of the journal in question. Another critical aspect for editors is the fact that many articles are signed by numerous others (at times over one hundred). How can you allocate merit among authors?

This document does not set out to discuss IM and CI as many detailed studies on this topic can be downloaded for those interested. More complex issues have been identified concerning on-line publications and open-source ones, plus the liquid-publication (clearly related to the liquid society represented by the philosopher Z. Baumann) addressed by a European projected financed within the 7PQ framework.

The Liquid Publications Project is based on the primary intuition that the evolution and use of items of scientific knowledge is similar to the evolution and use of open-source software. Both scientific knowledge and open-source software are complex, malleable, inventive conceptions of the human mind that spin off in multiple directions through collaboration. Further, just as computer software has become de-coupled from specific computer hardware; scientific knowledge has become de-coupled from the specific physical aspects of a scientific field through storage, manipulation, simulation, and recombination in electronic form. While scientific collaborations and collaboration technologies have advanced, the collaborative evaluation of scientific knowledge has not.

Scientific communities continue to evaluate scientific knowledge using essentially the same peer-review techniques used 100 years ago. http://project.liquidpub.org/.

It is essential to include the resources and support available for conducting research when assessing individuals' qualities. In other words, the products should be normalised with respect to the support provided. And this is not normally the case, as shown by the cases in Sweden (Wenneras and Wold) and the USA (MIT) where women receive less and are asked for more (*The Matthew effect*).

In the framework of *Gender and scientific excellence, Topic Report,* the project conducted by Elisabetta Addis assisted by Costanza Pagnini entitled *The meta-analysis of gender and scientific research 2011* states that "*The Matthew effect was introduced by Robert Merton (1968) and with reference to the Gospel where it is said: "For to all those who have, more will be given, and they will have abundance; but from those who have nothing, even what they have will be taken away" (Matthew 25:29, New Revised Standard Version).*
In addition, *"The Matthew effect manifests itself in two areas, funding and citations. In funding, projects of the same quality receive more funding if they include an eminent scientist. Evaluators tend to overestimate the accomplishments of scientists with an established reputation, whereas unknown researchers meet more reserve. In citations, the work of two authors is credited to the one who is already better known. A gender variation of the Matthew effect was also identified, and labeled the Matilda effect: achievements of female researchers are frequently attributed to their male colleagues or otherwise minimized and underestimated".*

It is noteworthy that in academia (Bice Fubini and Flavia Zucco, 2000) there are two currents of thought regarding how to apply assessment:

1. One school of thought considers assessment **an art** where criteria and procedures are defined each time. This option reveals the desire "to have a free hand" and reflects the power of the "old boys' network";
2. The second school of thought defines assessment as **a science**. It morphs into constituted knowledge provided with schools, teachers, books, associations etc. It consists of a corporation of self-referential experts who are the only people qualified to assume this role and thus hold the related power.

These are both typically male approaches and not aimed at guaranteeing the quality (efficiency and efficacy) of the activity performed for institutional goals, but rather at ensuring that power remains in the hands of those who wield it. Such approaches should be rejected. It must be pointed out that it is simply a question of identifying a method (with transparent and shared rules that can be changed, and in all likelihood, vary depending on technical and humanistic fields). This method has to guarantee the quality of the task performed, ensure assessment is not contingent on factors external to the value of the goal itself, and guarantee direct accountability of the examiner. Today, it is considered more appropriate to speak of a culture of assessment.

4.1. DEFINITION OF A GOOD METHOD

Any selection process method – from validation of in vitro tests to the selection of personnel - has to meet two main criteria to be considered valid: **relevance** to the characteristics required, and **reliability**.

4.1.1. RELEVANCE

Relevance refers to the significance and usefulness of the method to achieve its aim. First of all the framework of the context has to be defined and, in the case of scientific research, the characteristics "of those who are good at carrying out research" and "good research" have to be defined. At this point it is clear that from a female viewpoint all the male-oriented stereotypes and mechanisms have to be cleared away[3]. Simultaneously, indications that help build more updated and complex models of scientific research and those working in the field have to be provided. Such models necessarily have to be more refined.

Some of the components of these models are derived from the same structure as contemporary research:

- most research is public;
- quality of research is the gaol, but additional qualities are required;
- geared towards major goals of socio-economic interest;
- produce innovation;
- based on teamwork.

Thus persons carrying out research presumably have to:

- have working attitudes to achieve careful and responsible research
- have multifaceted scientific know-how
- have long term objectives
- be communicative and cooperative
- be able to promote self esteem and motivation in themselves and in the team
- be able to resolve problems, including technical and administrative issues
- welcome creative though and transmit culture.

[3] In order to avoid the inevitable question of quotas, please refer to John Stuart Mill's essay *The Subjection of Women* where he states "…*what women by nature cannot do, it is quite superfluous to forbid them from doing. What they can do, but not so well as the men who are their competitors, competition suffices to exclude them from; since nobody asks for protective duties and bounties in favor of women; it is only asked that the present bounties and protective duties in favor of men should be recalled.*"

Other components can only be the result of a wide consensus on the role of scientific research in advanced societies and not of the expectations of individual operators.

4.1.2. RELIABILITY

Once the reference context is set, a reliable assessment method must be perfected. In other words, the assessment protocol adopted must be able to work with the same accuracy (reproducibility) even if used in different situations and at different times. In the case of research assessment, it is a question of defining procedures that select suitable people/projects (for the pre-set objectives) as efficaciously and objectively as possible[4].

Alongside the so-called cold criteria, hot criteria have to be adopted in order to really assess individual's qualities and scientific activity. Applying relevance and reliability criteria to selection processes and assessment of scientific and technological research may change the same definition of quality of research and its subjects regarding the former, and changing the latter may correct wrongs and incorrect behaviour towards women.

Since 1994 a number of publications and reports analysing assessment methods/procedures have been conducted and involve entire universities, research centres, departments, projects and single individuals. Here specific reference is made to individuals because the focus is the weight of gender in assessment. Nevertheless, the most recent and significant studies state that there are overarching general principles, for example transparency, procedural reliability, relevance to goals, etc. (see REF-Research Excellence Framework- for the UK 2008-2014; the French report of the Academie des Sciences del 17/01/2011, htpp://www.academie-sciences.fr/activite/rapport/avis170111.pdf, as well as the Italian ANVUR report http://www.anvur.org/) LERU, 2012.

It is surprising that some of the considerations put forward in our 2000 document are now present in these papers and apparently accepted. The bibliometric criterion is downsized and flanked by other criteria, the basic principles being what has been previously said, including methods and procedures that strongly resemble those presented by us.

4.1.3. VALIDATION PROCEDURES

The procedure that determines whether a method is accepted is called validation, and it verifies both reliability and relevance. As previously mentioned, these two criteria are necessary, yet inadequate if used alone. Each assessment method should be

[4] Clearly this calls for strict definition, and possibly quantification, of the reference parameters. It must be kept in mind that quality can be expressed **as a score**, for example: excellent=4; very good =3; good =2; fair=1; poor=0. This is indeed the tool adopted by the European Commission for evaluating projects.

validated. The reasoning behind the validation procedures of methods, protocols and assays may also be useful for assessment.

A study group sets up an assessment procedure (having first defined the goal) and then uses it to perform a blind test on a series of available projects/curricula where some information that could influence the result is concealed.

Once selection has been made, the concealed information is made available in order to verify if the method adopted was satisfactory in terms of sensitivity and specificity: whether it was able to distinguish the information/methods pertinent to the objective, and among these, which were the most fitting. For example, in the field of research assessment the number of publications could be a very sensitive parameter, whereas impact factor could be considered very specific. The use of two parameters needs to be calibrated so as to avoid inaccurate/penalizing inclusion or exclusion.

The predictive accuracy of the method verified in the previous step could be used to review and readjust the assessment protocol to reduce the features that prevented it from being fully productive. Generally speaking, this stage of "refinement" should be put through a further blind test.

The UK assessment commission used this approach and also tested the methods on hypothetical cases to validate them.

CONCLUSION 3

Assessment procedures need to be changed. It is by no means easy to set such changes in motion as assessment is one of the prerogatives (having clout) of power. It is noteworthy that in addition to blatant resistance to change, there are more elusive positions halting change, especially in the academia. Moreover, accepting change is not enough: principles can just not be put into practice thus hindering change. Or, when change is set in motion unmotivated persons without special training may be involved (purposefully or not), thus scuppering the action and jeopardising the entire initiative. Another way of thwarting change is to provide generic action plans and indications that do not allow change to be easily identified and achieved. Finally, action is not always supported by adequate funding and resources.

All the points explain the difficulties encountered in introducing change in consolidated practices and the need to be aware of, and keep an eye on, them.

WHAT CAN WE DO?

Regarding **evaluation procedures** the first thing is to make some compulsory key changes:

- Use a broader and more inclusive concept of excellence

- Implement transparent and objective assessment procedures (accountability);
- Re-install decisional powers in official organisations;
- Improve exploitation of research in multidisciplinary fields, currently considered "borderline";
- Assess scientific outputs normalized against resources inputs (grants, apparatuses, personnel);
- Abolish gender bias (quotas for men) in favour of meritocracy, assessed according to new criteria.

Concerning the evaluation boards they should comply with the following criteria:

  - Gender balance in evaluation boards
  - Training evaluators, peers and chairpersons in gender issues

It is clear that the persons called to make an assessment have to be qualified to carry out the task. In other words, in addition to their expertise in the discipline, they have to conform to the criteria of *independence, impartiality, professionalism, discretion and transparency.* They must also possess a "culture" of evaluation allowing them to comply with the core principles, the criteria selected to detect possible bias. The setting up of commissions of different gender and competencies could facilitate this approach. The above-mentioned official documents refer to external experts, such as *informed peer reviewers,* alongside experts of the disciplines in question to ensure that interdisciplinary and other aspects are covered (why not gender?).

Undeniably, the presence of 25% of women in ANVUR (Agenzia nazionale per la valutazione dell'Università e della ricerca - Italia), neither reflects the percentage of researchers assessed, nor does it necessarily guarantee the vision of gender. In any case, appropriate **tools** have to be selected from those available and adopted, adjusted fittingly, and possibly combined. Some of these tools are listed below.

CURRICULUM VITAE

It can adopt a format proposed by the organisation highlighting important aspects, or one of personal choice. The latter has to provide an unequivocal and honest classification of the various activities.
The following have to be attached. At least ten important scientific publications related to the candidate's areas of activity, or the publications of the last five years. Women returning to their careers after maternity leave may present more publications, or publications from over a longer period.
The CV can contain additional information providing a more complete profile of the candidate and the candidate's interests (e.g. activities regarding the dissemination of science, such as exhibitions, media interviews, etc.).

INTERVIEWS

To assess research attitude, motivations, aspirations.

FACE TO FACE LESSONS

To assess teaching skills

DISCUSSION OF A PROJECT

To assess capacity of analysis and knowledge of the subject in question.

The table below provides two examples of assessment procedures. One is more traditional and restrictive, while the other is more advanced and innovative.

Traditional system (Ana Proykova EPWS) WISER Festival in Maastricht Oct. 2007	**Innovative system** **Swiss National Foundation**
Quantitative estimates • Number of publications (articles, books…) • Number of citations • Numbers of patents • Number of projects • Numbers of students • Numbers of coworkers	**Criteria** • Experience in research and teaching • Quality of the scientific proposal • Attitude for academic career (independence, charisma) • International experience (mobility) • Possibility of integration in the University system
Criteria • Publication in good quality, peer review journals • Innovation and quality of the output • Relevance for the society • Advancement of the state of the art. • Regular presentation at conferences • Good communication with the public • Assess scientific outputs normalized against resources inputs (grants, apparatuses, personnel); • Resources for research and facilities • Citation frequency • Good leadership (team building and supervision abilities) • Competitiveness and awards.	**Tools for evaluation** Interview: • Charisma • Independency Autonomy • Capacity to communicate • Teaching skills • Motivation • Long term personal goals Scientific aspects • Clarity of presentation • Precision of presentation • Plausibility of argumentation • Competence for the project • Broad knowledge of the field • Presentation of long term goals • Evaluation Scale: excellent, very good, good, fair, poor

It is clear that the traditional approach does not necessarily involve the candidate and his/her qualities/capacities are assessed by pre-set written criteria, whereas the innovative approach is totally different. This comparison reveals how assessment is still interpreted differently in diverse cultures, organisations and countries.
In the GenisLab we discussed various types of assessment but, on the whole, we considered all of them unsatisfactory.

GENERAL CONCLUSIONS

Much has been written on excellence and assessing excellence. This paper aims at striking ahead, at systematically underlining the need to adopt new criteria.

The new context calls for insightful change. Undeniably, science is an indispensible, intellectual activity, but it has to be functional to contemporary society and respond to the criteria of equality that the persons involved (especially women) are demanding to meet today's social and ethical requirements.

The paper examines assessment and proposes new criteria, tools and procedures. Indeed, it reveals that they are already adopted in some very qualified organisations, that change is underway, and that this can trigger off a more advanced debate on the whole process of assessing excellence.

If recruitment and promotion of adequate professionalism does happen, this new approach will be beneficial to science, society, and above all to men and women working in research who could find new interests to focus their attention on.

In particular, women could be encouraged by criteria recognizing scientific merit that they are demonstrating at high levels along with other capacities required for scientific activities. It is clear that women's multifaceted behavioural qualities are very advantageous to research and ring changes in the extremely competitive and discriminating arena.

We will probably be blamed for proposing positive "stereotypes" that help women practise scientific research and provide science with original contributions and virtuous behaviour. In an attempt to put such changes in motion, we should not hesitate to propose new generalisations, not so permanent as stereotypes, and new more attractive models of women scientists.

More than a century ago, J.S. Mill wrote a letter to August Comte on 30 October 1843 stating that "*….to consider how the organisations, goals, and research priorities of science might be restructured by taking into account the experience of women, because that is a perspective that has been neglected".*

Flavia Zucco

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ANNEX 1

This chart has been developed by Prof. Mina Teicher* within the meta-analysis EU Project

TEACHING
- High level frontal teaching (updated, interesting, methodology)
- Evaluating (oral or written exams)
- Advising graduate students (building research proposals, follow-up on the work..)

RESEARCH
- Research, creating new knowledge
- Distribution of knowledge- Writing manuscripts
- Distribution of the new knowledge- Publishing in refereed journals with impact factors in a timely fashion
- Distribution of the new knowledge- Giving lectures and colloquia
- Applying for grants
- Networking
- Winning grants
- Raising funds for research
- Creating a research group – develop a field
- Building the next generation

OUTREACH TO SOCIETY
- Public speeches
- Newspapers articles
- High school education
- Social responsibility Projects

ADMINISTRATION
- Department, faculty meetings
- Department and Univ Committees
- Serving as chair
- Climbing up in the uni hierarchy

SERVICE TO THE SCIENTIFIC COMUNITY
- Writing referee report for manuscripts, Phd Thesis
- Activity for the professional organization (National and international)
- Serving in research bodies, funding agencies,…
- Helping former students and postdocs in building a career)
- Editorship

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ANNEX 2

Assessment by Bulk

by Flavia Zucco

The recent debate on Italian university public examinations for the recruitment of researchers and teaching staff has raised many issues, including the problem related to how to assess candidates' scientific publications in CVs. In a field where even a crumb of scientific seriousness and moral rigour (but what is that) would revolutionise things, the universal remedy of an objective method is advocated. Naturally the idea is not ours, but comes from the USA.

The objective method would award a score to publication depending on the number of times it is cited in a given time interval after publication (citation index or quotation index), or the popularity of the journal it is published in (impact factor). Obviously, I have oversimplified the criteria, in reality the "significance" of a given publication can be balanced in various ways, by combining factors, including correctives, etc. The goal is to provide a number, an objective assessment, able to trounce the most sophisticated arguments and neutralise powerful political ploys. It is a real pity that this system has been challenged for many years (at least 4-5) worldwide, also in the US.

There are two orders of problems. The first general issue worries the editors of scientific journals and is changing the scene of scientific information[5], while the second questions the validity of the method to assess single researchers' careers [6] [7].

Let's look at the first aspect. The fact that assessment of a single researcher or a group of researchers (for example to obtain funds, etc.) is based exclusively on papers published in specialised journals jeopardises such journals and puts them in a very delicate position where they may become the cause of unscrupulous conflicts and vehicle what is not always fair play. There have been radical changes in the form and production of scientific literature that has impacted, often negatively, on the dissemination and accessibility of scientific knowledge in terms of rigour, correctness and new data.

One of the primary factors of the issue is that the outpouring of publications does not allow researchers in a specific sector to keep updated. Consequently, the same referees have difficulty in reaching a correct and pondered decision on the quality of the paper to be published. The rush to get the paper published before someone else publishes the data has led to poorly written papers containing incomplete, or even fraudulent, data (the best-known cases of fraud can all be ascribed to fierce competition to get research to the press first). Scientific journals are being requested more and more frequently to correct published reports, and even to withdraw entire papers [8] [9] [10].

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[5] **J.Maddox**, Competition and the death of science. *Nature* vol. 3363 (1993) p.667.
[6] **D.P. Hamilton**, Publishing by-and for?- the numbers. *Science* vol. 250 (1990) p.1331-2.
[7] **L.Roberts**, The rush to publish. *Science* vol. 251 (1991) pp. 260-263.
[8] **F.M. Menger** and **A.Haim**, Struggles to correct published errors. *Nature* vol. 359 (1992) pp. 666-668.
[9] **J.Maddox**, Melodrama in research publication. *Nature* vol. 355 (1992) p.767.
[10] **J.Maddox**, Conflict of interest declared. *Nature* vol. 360 (1992) p.205.

At this juncture the traditional peer reviewing system reveals its intrinsic weakness, also of ethical nature. The editorial boards of scientific journals are swamped with papers that the members should read carefully and comment extensively in any spare time not dedicated to their profession, without receiving any remuneration, yet they are also competitors of the group they are assessing. J. Maddox, editor-in-chief of Nature, reported an interesting and pertinent case study demonstrating the improprieties and abuses committed in situations of this type. It also revealed the difficulties scientific journals can encounter and the consequent need to radically innovate some of its policies.

Another aspect requiring regulation is the issue of "hyper authored" papers. This seems essential in some sectors of molecular biology or medicine (e.g. epidemiology) where the topic of the publication concerns the creation of databases. The hyper authored paper (i.e. with over 200 authors) that highlighted the importance of this issue once and for all was published in the New England Journal of Medicine. In June 1994 Nature published a multi author paper with 108 authors. The editors hoped that all the signatories had really participated in that study[11]. In other words they hoped that the questionable practice of including the names of those who only provided a material datum (unless the person had requested a specific task involving that research) be discontinued; or that the habit of including the names of the heads of laboratories and departments, who in most cases do not give any contribution, be stopped. Regarding this point it, must be kept in mind that this practice is usually reciprocal, and thus the head ensures that he/she has sufficient publications to guarantee his/her future career, the young researcher is protected and guaranteed by his/her chief when it comes to appraisal of the study by the latter's "important" peers.

The fierce competition has determined another shift in scientific literature, i.e. more and more assertive titles. As from 1990 J.L. Rosner raised the problem and has harshly criticised this habit in Nature[12]. He pointed out that, in particular, molecular biology used this type of title, confirming yet again the pressure it is under to be a goal-oriented science (leaving aside the epistemological meaning of this shift; in effect it greatly consolidates the image of a science of certainties and source of undeniable progress).

Now we address the other aspect of scientific competition involving assessment of single researchers and their scientific output. The real critical point occurred at the end of 1990 when the Institute for Scientific Information (Isi) published statistics revealing that 55% of the scientific papers published between 1981 and 1985 had not been cited in the five years following publication. By adding the papers that had been mentioned, only once to the percentage, the total came to 80%[13]. Obviously, this Isi report created an outcry and animated reactions. It emerged that most eminent representatives of US universities and institutions shared the view that academic culture encouraged spurious publications, and that single researchers were pressurised to produce quantity rather than quality, i.e. bulk, to gain promotion and receive funding.

Isi is a private institute headquartered in Philadelphia and its database contains all the original papers and bibliography reported in about 4,000 scientific journals. Every year

[11] **J.Maddox**, Making publication more respectable. *Nature* vol. 369 (1994) p.353.
[12] **J.L. Rosner**, Reflectons of science as a product. *Nature* vol. 345 (1990) p.108.
[13] **G.Tauber**, Measure for measure in science. *Science* vol. 260 (1993) pp.884-886.

this institute publishes 10 issues of the newsletter Science Watch providing all types of statistics regarding contemporary science and its trends.

Nonetheless, reservations and criticisms have been levelled at Isi regarding the journals selected, these being only a very small part of the 108,000 existing ones. Apparently, selection is based on value criteria (the most prestigious), but not only (the most disseminated, the oldest). There is no doubt that many non-English-language journals, as well as highly specialised journals (clearly only read by specialists), have not been included, and that US journals have benefitted.

The survey of the papers includes everything in the journal from the first to the last page (according to the director of Isi). Therefore, not only original papers, but also reviews, letters, comments and so on, are included in the citation index. Hence, the data reported by Isi are strongly influenced by the database set up that seems rather questionable. The person-in-charge state that nonetheless the overall message is still valid as the real influence of some operative decisions would be slight. They object in more detail to more specific objections, e.g. the effect of the widespread practice of citing oneself (legitimate when presenting results connected to a given line of research the previous ones obtained by the author are cited; not so legitimate when one deliberately only cites oneself, and not others who furnished relevant contributions in the sector, in order to raise one's CI) would be only 5-20%. High Citation Indices resulting from negative citations, like the case of the famous paper by Pons and Fleshman on cold fusion, seem to be rare and would not amount to over 7% of cases. Likewise, the incidence of citations of routine methods used that would determine very high Citation Indices is insignificant.

The real problem arose when this newsletter attempted to set itself up as a benchmark for academic and non academic institutions, giving itself a value far beyond its real one and one not supported by the necessary seriousness and precision for it to be adopted to assess the careers of single researchers, or the scientific quality of groups, institutions, etc.

Many sociologists of science are alarmed by the use of Isi data and believe it has introduced aberrations into the scientific world. They also feel that the resulting fierce competition has jeopardised research and the damage is now becoming clear to all. "Time for thought has been eroded" and this undermines the solidity of the same scientific results.

In any case, assessment of individuals is not facilitated (especially if they are one of 200 multiauthors). Indeed, appraisal should assess the quality of their work, their contribution to the field of research, along with more complex skills, such as team-working and talent that make individuals suitable for their role they hold or the funds they manage.

J.Maddox, editor-in-chief of Nature, claimed that objective Citation Index type assessments were equivalent to the bulk (in grams) of publications, and D. Koshland, editor-in-chief of Science went even further when he pointed out that the Citation Index was the product of a database and not a religion. This uproar caused the same Isi to advise that its Citation Index should never be used as to replace careful human appraisal

of an individual. Diversely, it should be adopted to assess more complex bodies, such as entire research groups, institutions, and departments.

Nevertheless, some have decided to settle things once and for all and study ways to dampen competition in terms of publications. Indeed, from now on the Harvard Medical School will only take into account the 5-10 most important papers indicated by the same candidate, and other US institutions are following suit. In Europe, some countries, such as Germany and France, pay great attention to these issues and seem heedful not to repeat such unfortunately experimented errors in their institutions.

But what about us? We rush to take out a subscription to ScienceWatch!