Key elements for excellence in research: a contribution from EU-LIFE

JULY 2016

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Introduction

EU-LIFE (www.eu-life.eu) is an alliance of thirteen European research institutes in life sciences whose mission is to promote excellence in research. EU-LIFE partners believe that by joining forces and sharing good practices they can better address complex questions in research, training and research management, thereby pushing European science forward.

EU-LIFE partners share the view that scientific excellence in the 21st century can only be driven through strong adherence to principles of scientific curiosity, creativity, high quality standards, scientific integrity, ethical responsibility, societal accountability, ecological sustainability, and cultural inclusiveness, while promoting a strong dialogue with society. The alliance has a long term mission to share these values and best practice within Europe, to other institutes, existing or new.

Within the scope of EU-LIFE's mission, the Strategic Working Group of EU-LIFE, gathering members from 13 research institutions, has performed a brainstorming session to discuss the definition of research excellence and identify key elements that contribute to it. We aimed at using current policies and practices of EU-LIFE research centres as a starting point to identify key elements that promote excellence at institutional (research centre) and individual (principal investigator, PI) level.

We believe that by sharing these reflections we can learn from each other, inspire research centres to "be better in the future" and promote good policies and practices among different stakeholders.

What is excellence?

Research excellence has become a "buzz" word. Politicians, policy makers, funding bodies, academics and other stakeholders use the term in different contexts. In addition, more and more rankings based on so called 'performance indicators' are becoming widely used – and misused - to influence decision makers. The usage of these performance indicators has a broad impact in science by influencing the evaluation of research units and career development of individual researchers; framing individual recruitment; justifying funding / cutting policies, etc. What is more, researchers themselves are increasingly using these metrics even though at the same time they acknowledge their shortcomings.

But what is excellence? Before discussing how to nurture excellence, it is crucial to agree on a definition. In the current exercise, we will use a definition of excellence at two levels: at the level of the individual PI and at the level of the research centre:

An excellent researcher (PI / group leader) is an expert (or a researcher with potential to become an expert in the case of young group leaders) in her/his research field with an outstanding level of international recognition for her/his impactful contributions to the field, as evidenced by landmark lead author publications. She/he will also have other markers of esteem

awarded by peers, and a clear and strong vision on the future developments within her/his area of research, which is translated through challenging research plans. Furthermore, she/he is a teacher and mentor for the next generation of scientists, performs research according to the highest qualitative and ethical standards and is actively involved with her/his research institute strategy.

A centre of excellence harbours a critical mass of excellent researchers, all contributing to an open, diverse, interactive, collaborative, creative and critical environment in order to perform impactful research with international visibility. It provides researchers with state-of-the-art facilities, infrastructure, advanced training and support and operates according to the highest ethical and business standards. As such, it is able to integrate and promote talent and its circulation as well as adding value to knowledge and to society.

Key elements for excellence in research centres

Measuring and promoting excellence in a research centre is an institutional challenge. Whereas there is no one-size-fits-all measure, a series of key ingredients can be identified. We draw from experiences shared among EU-LIFE partners to identify common, key ingredients for excellence in research. Whereas some of these are universally accepted, there is some space for debate in others. We opted to present them as topics in four main areas (1. Stimulating environment and state-of-the-art resources; 2. Knowledge transfer; 3. Human resources; 4. Assessment and quality), hoping that they will help trigger reflection and promote institutional as well as individual change towards an even more impactful, responsible and exciting scientific endeavour.

1. Stimulating environment and state-of-the-art resources

An excellent research institute is a place where a highly skilled workforce develops world-class research. Management of a research institute should create a setting that maximally stimulates and allows researchers to flourish. This includes creating an open, diverse, interactive, critical, creative and collaborative research environment which nurtures scientific integrity and promotes the creation of a strong community as well as providing the best possible research environment. The following elements should be considered:

Fostering an interactive scientific culture
- Stimulating a culture where constructive criticism and challenging ideas are appreciated in an engaging environment. This can be created by having collective work discussions in which everyone is invited to actively participate irrespective of her/his position within the organisation. E.g. PhD and postdoc seminars with feedback on presentations, journal and data clubs, postdoc and PhD students led symposia, opportunities for postdocs and PhD students to meet high calibre invited speakers, etc.
- Ensuring that leadership is accessible, with a light hierarchical institute structure
- Engaging the whole community in developing strategies and participating in decisions that affect the whole institute, for example recruitment

- Implementing a recruitment strategy that promotes intra-institute collaborations: recruitment of PIs that are open to collaboration and interested in the whole institute's science and not solely focused on their own topic
- Establishing shared research facilities that bring together researchers from different groups
- Facilitating spaces to promote scientific discussions and interactions in an informal way, e.g. open labs and offices, communal areas that include open doors, coffee rooms and informal meeting spaces, social events for the whole community

Nurturing scientific integrity
- Maintaining a high level of scientific integrity with clear guidelines for all personnel: developing a cohesive policy which includes the principles of responsible research, including ethics of publication and data management plans supporting the prevention of fraud
- Promoting standardised practices of data capture, archiving and management (electronic lab notebooks, repositories)
- Whole staff training and follow-up procedures regarding responsible scientific conduct (including among others good scientific practices, proper experimental design and statistics, conflict of interest management, data and image manipulation, research ethics, patient data management, GMOs, biosafety and research with lab animals)
- Developing authorship guidelines (including facilitating senior authorship for senior postdocs and strategies on giving appropriate credit to contributors at all career stages)
- Stimulating a critical environment in which everyone feels safe to address potential issues regarding scientific integrity
- Facilitating conflict resolution, for example, by creating a commission of peers or research integrity officer (ombudsman) for grievances (e.g. authorship, scientific misconduct, harassment, etc.)

Creating a strong community
- Identifying and emphasising explicit core values of the institute
- Encouraging an HR strategy promoting recruitment of top researchers who are also engaged with the core values of the institute
- Creating a sense of belonging to a community: desire of belonging to a stimulating environment, bringing people together via joint scientific, training and social activities
- Providing an opportunity for informal interactions through retreats or other informal gatherings: important to develop a successful community through social activities as well as through its science
- Integrating new lab members – e.g. coached by most recent addition to the lab
- Acknowledging cultural differences, being open-minded and encouraging tolerance, being supportive to colleagues, stimulating individual success and in turn the success of the institute
- Supporting a strong and vibrant alumni community

Resources
- Maintaining state-of-the-art infrastructure with access to emerging and established technologies (including institutional core facilities), open to everyone in the institute

- Fostering a motivated and highly-skilled administration that takes initiatives and supports scientists
- Providing a competitive start-up package for PIs
- Having a budget to promote strategic initiatives (e.g. interdisciplinary programmes, institutional collaborations, joint projects, PhD/postdoc initiatives, seed funding)
- Providing training, mentoring and career advice to the scientific community
- Having strong research offices that proactively scout, attract and manage competitive grants, including offering internal review of grant applications and support (e.g. peer-mentored) for highly competitive, international grant applications

2. Knowledge transfer

Knowledge transfer is a priority for research centres of excellence and should target different groups: the scientific community with whom results are shared, the students as the next generation of top scientists, industry and other economic sectors as key players of the innovation environment, and society at large as stakeholder and ultimate beneficiary of scientific research.

Publications
Publications are the key means to share results and findings with the (scientific) community and thereby advance our collective understanding. In relation to publications, excellent research institutes should:
- Encourage open access publication, including developing an open access policy and support to comply with it
- Expand the policy of open publications to other research outputs such as databases, datasets, software, technological development, etc.
- Prevent unnecessary delays in publishing data
- Stimulate active and fair participation in the review process
- Make sure individuals' contributions are acknowledged properly in papers based on the scientific input made by each and every one

Technology transfer and sharing of non-publishable research products
A core value of a centre of excellence in life sciences is to translate new scientific knowledge into value for society. This can be realised through a process of tech transfer, translating new knowledge into intellectual property (IP), with the ambition to translate it into valuable products for society: drugs, vaccines, diagnostics, crops, etc. In order to promote the transfer of technology, an institute should:
- Acknowledge that there are different institutional models to incentivise technology transfer
- Ensure proper IP management
- Hire professional staff to promote and support technology transfer
- Provide training for researchers on IP-related issues
- Promote interactions with companies on fair and reasonable terms
- Promote the start up of new companies
- Promote a culture of unrestricted academic exchange

- Promote staff exchanges throughout the organisation with other research institutes and other parties to share experiences and skills

Communication with policy makers

Research institutes need to foster a dynamic dialogue with policy makers at national and European/international levels namely:

- Taking action to understand the system in which policy makers operate in order to be an advocate for science beyond its own institutional priorities
- Acknowledging the specific needs of policy makers in terms of types of interaction (e.g. producing publications aimed at policy as distinct from scientific articles) and timings; and promoting direct, personal interaction between scientists and policy makers
- Investing both at institutional and individual, scientists' levels in building open and ethical relationships with policy makers
- Fostering cooperative action in scientific policy with other institutions and stakeholders
- Considering the regional, national and international dimension of policy making

Communication with society at large

It is the obligation for scientists to reach out to society and communicate to the general public about their work, findings and its relevance, not only to justify the means and trust that society puts in science, but also to increase scientific literacy and motivate young people towards a scientific career. Research institutes should:

- Actively foster engagement of citizens with, and in, the different aspects of science and innovation
- Promote the improvement of scientists' skills to reach out to the general public through training and opportunities of real engagement
- Have dedicated professionals in science communication

3. Human resources

Science is critically dependent on people. Having the right person, at the right position, and keeping all the employees and collaborators motivated should be a major focus for the research institution. Excellent research is inclusive and diverse and considers the career development of its contributors.

Inclusiveness and diversity

Science is one of the few truly international activities. Researchers from all over the world practice their skills, collaborate, meet and exchange data with similar professional standards regardless of nationality, ethical or religious background, gender or age. Therefore, anyone capable and motivated to join the scientific community should be given the opportunity to do so. At the institutional level, the following issues should be considered:

- Fostering of internationality at all scientific stages as well as within core facilities and administration
- Promotion of a good gender balance at all positions, especially the higher research and management positions. In order to achieve this, a proactive policy should be implemented to exclude gender discrimination and biases

- Creation of a safe environment in which people with diverse backgrounds can work together with equal opportunities
- Mobility among institutions - and in particular international mobility - should be encouraged
- Mobility within Europe has different context/needs compared to the mobility towards Europe. Therefore, a strategy to attract people to European institutes and to facilitate administrative processes is needed, especially for international recruits (e.g. relocation, visa, etc.)

Career development

Most employees of research institutes are in the process of developing their career and this should be promoted and properly supervised. It is important to:
- Consider the need for transparency in the career development possibilities inside the institution
- Implement annual career/performance reviews for everyone within the Institute that provide constructive, fair and open feed-back and with discussion of possibilities for improvement
- Nurture a culture of progress by establishing dynamic objectives that keep progressing each year
- Provide opportunities via tenure, tenure/track or ensure that young PIs, when their term at the institute ends, are competitive to apply for jobs elsewhere
- Provide (realistic) start-up packages for PIs that allow them to start their research without delay
- Provide opportunities for unconventional career paths
- Establish mentorship programmes for young PIs and coaching for established PIs
- Ensure annual review of PhD students using a PhD committee
- Develop a training programme for all staff (administration, research and support staff), i.e. identify specific deficits in staff training and provide this training
- Acknowledge that training in scientific and transferable skills is a powerful tool for career development and knowledge transfer. Training should focus on skills and include hands-on workshops. Career development should be regularly discussed at all stages of the scientific career, including for technicians. It could be relevant to have "skills market places", to promote development of transversal skills based on the idea that these skills are helpful in research (PI), as well as for careers outside research
- Be sensitive to the stresses that scientific careers, in whatever function and at whatever stage, can impose that may impact severely on employees, thereby preventing absenteeism.

4. Assessment and quality

A research institute can only obtain and maintain a high level of excellence when it critically reviews its own performance and is able and willing to draw conclusions based on the outcome of this evaluation. As research institutes are so different, assessment of quality is extremely complicated and many aspects have to be taken into account.

Research excellence needs vision, creativity and diversity, i.e., a combination of criteria and not a fixed set of quantitative measures. Hence, qualitative analysis is of the essence and more representative than a quantitative analysis based on a (limited) number of quantitative metrics; and peer review is an essential part of assessment.

There are at least four different levels at which regular assessment should be implemented: global institutional assessment; PIs; all other personnel; and Directors. In all of them, evaluation should be promoted as a constructive, quality improvement process.

Assessing excellence at the institution level

Research institutes exist in very different contexts due to legislations, funding systems, research programmes and local situations. Assessing excellence at an institutional level should take all of these into account. Nevertheless, each institution should periodically undergo review to identify its own strengths and weaknesses for the purpose of improving the research further. In order to do so institutes should:

- Implement regular review of the performance of the institution according to a transparent protocol
- Carry out evaluations by an external body comprising of excellent scientists with deep knowledge of the research field(s) and deep knowledge of the institution's context
- Use peer review to assess research performance at the institutional level
- Use quantitative indicators (KPIs) to complement qualitative institutional assessment, but not at an individual PI level
- Also consider activities in technology transfer, translational research, attraction of competitive external funding, training, human resources, communication and engagement with society
- Take into account the success of alumni
- Evaluate the director and her/his role in the institute at the same time as the institute
- Ensure that results of evaluation and advice provided to the institute are transparent and suggestions for improvements are implemented as much as possible

Assessing excellence of PIs

Similar principles are appropriate for assessment of PIs. Peer review (by external, independent peers) is essential in assessing the performance of a PI as many factors have to be taken into account in a constantly changing international environment. A positive outcome of a peer review should be a prerequisite for further institutional support to the PI.

Assessment of the PI (group) should include the following elements:

- A fair, transparent and rigorous procedure which applies to all PIs should be in place
- Institutes should aim for all their PIs to be successful by providing excellent support and mentoring
- Evaluation should be based on clear and transparent criteria that the PIs are informed of at the time of their recruitment. Evaluation should be based on scientific achievements, as well as engagement in other institutional activities, such as technology transfer, communication, training, etc. The weight of these criteria could change from institute to institute depending on its specific objectives and core values.
- Assess both scientific and leadership achievements. Publications and grants should be considered by the panel, but the main criteria should be the originality and impact of the research in the PI's field.

- An analysis of content and impact of papers and patent applications should be performed
- Qualitative assessment regarding the three general measures of impact, namely impact in scientific field, contribution to the institute (including training), and impact on society (including tech transfer) should be sought (e.g. a general performance report on the categories separately such that any of the three areas are not overlooked)
- Assess scientific past performance, vision, and plans of the PI for her/his research group
- Evaluate management and leadership skills of the PI by group interviews including technicians, postdocs and PhD students
- Follow up future positions of postdocs and PhD students (destination after leaving the institution)
- In the event that research groups are not further supported at the institutional level, an individual outplacement plan should be designed including the fulfilment of institutional commitments towards PhD students, postdocs and external contracts.

Assessing excellence of all other personnel

The assessment of all other personnel of a research institution (postdocs, PhD students, technicians, support personnel) should be done based on clear standards, which includes:
- Job descriptions for all positions
- Periodic job evaluations aimed at improving performance
- Career development plans for individuals

The role of the Director

The institute's director should make the promotion of excellence and quality her/his prime focus of attention and take an active role in this by:
- Setting a philosophy / strategy for excellence and quality that should be dynamic and realistic
- Ensuring that PIs become acquainted and socialise within the institution's community
- Ensuring proper balance of time spent on evaluation/advice
- Developing a culture that should survive after the departure of the director
- Protecting the institute against political and granting agencies pressure
- Ensuring a balanced composition of the Scientific Advisory Board (SAB) regarding expertise, gender and knowledge of the institute/international context
- Having a clear policy / procedure for evaluation and executing it accordingly
- Having a clear policy on malfunctioning and inoperativeness and acting accordingly when needed

Evaluation as a constructive, quality improvement process

Evaluation is often used and perceived as a judgement that calls for punishment. It should however work as a tool to help improve quality and allow those involved to progress and take the next step. For a fair and ethically driven evaluation, the following principles should be considered:
- The role of the institution regarding evaluation processes should be supportive, not restrictive

- Work with external reviewers. Reviewers (peers) should come from different disciplines and be distinct from the Scientific Advisory Board (SAB) – there should be an effort to connect these different groups
- Promote transparency and good practice: evaluation and scientific "advisory" boards are currently too frequently misused to exclude people. For transparency of evaluation and assessment written reports and a possibility of rebuttal are needed
- Key Performance Indicators (KPIs) in research are difficult to use meaningfully; currently, there is not a well-defined and broadly accepted set of KPI's which accurately and universally captures the quality of research. If institutions would like to use KPIs, a blend of clearly-defined qualitative and quantitative KPIs should be decided on, to be used at institutional, not individual PI level and in such a way that they do not lead to manipulative behaviour.
- Nurture a culture of mobility: people should leave with a good feeling; it is important to maintain a positive morale in a dynamic system that is based on high turnover

Afterword

Excellence in research needs continuous efforts for development and growth, otherwise it can quickly wither and die. The only way to achieve and maintain excellence at the institutional level is by creating a culture in which quality of research is the one and only driving force. The best researchers (whatever their background or stage in their career) should be attracted to an institute where they are given optimal opportunities to do their research and develop their skills. Quality should be recognised and rewarded; failure to deliver quality should be addressed and should lead to improvement or alternative choices. An environment that values the best science should allow researchers to focus on the science, and foster an open, critical, collaborative, stimulating research context.

However, there is no one-size-fits-all model to achieve excellence in research. The current document resulted from peer-to-peer discussions within the EU-LIFE Strategy Working Group with the aim of exchanging good practice and promoting its cross-fertilisation among research institutes regarding key elements that make excellence in research thrive. The ambition of this document is simply that: to be a practitioners' contribution to the long lasting discussion about the challenges of leading a research institute and building excellence from an institutional perspective.

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