Roles of early career researchers in European collaborations in nano S&T

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Introduction: why focus on early career researchers and collaborations?

What role do early career researchers – PhD candidates and Post Docs - play in European research networks in the emerging field of nanosciences and technologies? Are they simply carrying out experiments designed by senior scientists? How much influence do PhD researchers and Post Docs have on collaborative research activities, choice of partners and co-authored publications? What are their positive and negative experiences from international collaborations? These questions are of great relevance for understanding the contributions and treatment of early career researchers in a research field that strongly depends on the laboratory work performed by them.

This topic is of growing interest for research policy studies and practice. In recent years, a number of studies have addressed the situation of early career researchers in the context of increasingly competitive scientific careers and fairness in allocating credit for co-authored publications. Scientific careers have become more uncertain with many early career researchers working on short-term contracts and competing for a limited number of permanent positions (Sigl 2016). In many science fields (e.g. natural sciences, laboratory sciences), research careers and collaborations are tightly connected because publications, which are the main currency in the academic job market, result from collaborations and are co-authored (Müller 2012). It is of major importance for early career researchers to be included in the author list and to be the first authors, indicating their key role in preparing the publication.

Studies on co-authorships demonstrate that the allocation of credit for collaborative research is far from straightforward, can include tensions and challenges, and differs considerably across disciplines, countries, institutions and researchers. Bozeman and Youtie (2016) demonstrate that rather than being based on actual contribution, authorship allocation can also depend on power dynamics, excluding deserving junior researchers and including undeserving seniors.

Recently, challenges faced by early career researchers have also been on the agenda of the European Union's research policy. In 2016, during the Slovak Presidency of the Council of the EU, the Bratislava Declaration of Young Researchers was launched (European Union 2016). The Declaration addresses a number of problems of young researchers such as 'an extended period of career insecurity with non-transparent career progression' and 'the current 'publish or perish' and hyper-competitive environment' is described as 'toxic to the research endeavour as it encourages extreme individualism, and is linked to an increase in fraudulent science'. Against this background, the Declaration calls for the reorganisation for research funding, the creation of sustainable and transparent career trajectories, the development of a collaborative, interdisciplinary and ethical research environment as well as a healthy work-life balance.

In the context of an emerging research and policy agenda focusing on early career researchers, this paper provides insights into the positive and negative experiences of early career researchers with international research collaboration in nano S&T.

International research collaboration

International research collaboration and mobility plays an important role for early career researchers. While science has historically been international (Wagner 2008), international research collaboration today has intensified (Wagner, Park & Leydesdorff 2015) due to many reasons including the increasing complexity of science, escalating costs of research infrastructures, the development of information and communication technologies and a need to solve cross-border social and economic problems known as 'Grand societal challenges' (Ulnicane 2016).

While there are many definitions and operationalisations of international research collaboration, here it is understood as joint research activities among scientists based in different countries (Ulnicane 2015). To study joint research activities in depth, this study uses a process model of long-term international research collaboration (see Figure 1) consisting of emergence and renewal, formal (within common externally funded projects) and informal (outside common externally funded projects) collaboration and diverse types of results including co-authorships, training and follow-up projects. Long-term collaborations move back and forth between these different elements and include important feedback loops where successful earlier collaborations, e.g. training of young researchers, lead to renewal and continuous interaction.

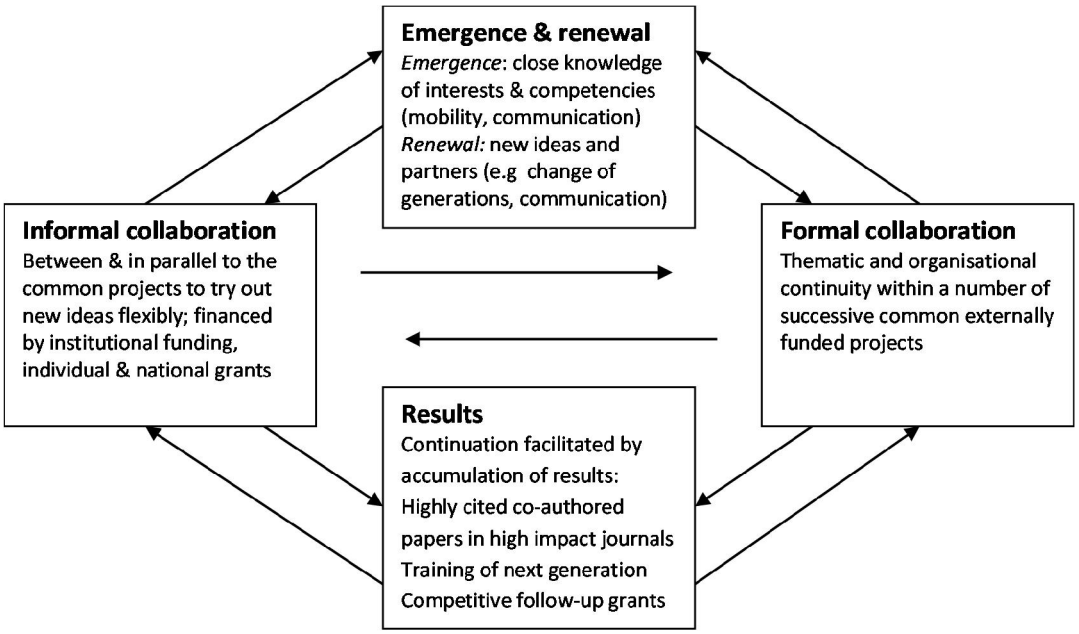

Figure 1: Stylized model of long-term international collaboration process in nano S&T (Ulnicane 2015: 440).

Methods and data

This paper draws on extensive empirical research on European research collaborations in nano S&T including 61 semi-structured interviews with senior and junior scientists, site visits to 31 research institutes as well as project, publication, organizational and CV data (Ulnicane 2015). Seven longitudinal case studies were undertaken of research collaborations lasting over 10 and 25 years. Collaborations among leading institutes in

nano S&T in Germany, the Netherlands, France, Belgium and the United Kingdom were studied. While some European collaborations studied took place informally, others were funded by the EU Framework Programme projects which provide funding for PhD and Post Doc positions and support their research training and exchange visits.

Insights: roles, benefits and challenges

Within a broader study of European collaborations in nano S&T, the role of early career researchers emerged as one interesting topic. Senior scientists with long-term experience in European collaborations admitted that one of the important changes that has taken place over years is the increasing involvement of early career researchers in collaborations. An institute director tells:

'what is so astonishing at European level is of course that young people interact. You have a group meeting and you have a dinner and they talk, they interact. When I was a PhD student the boss would travel and we would stay at the lab and do the work. That has changed.'

The active involvement and training of young researchers has become an important policy focus and many funding schemes, for example within the EU Framework Programme, require training and exchange of early career researchers (not ony in dedicated Marie Curie training networks but also in other projects). Active communication and interaction among early career researchers can be an important asset to collaborative projects facilitating joint research activities and co-authored publications. International research collaborations allow young researchers to not only acquire additional scientific knowledge but also to learn the 'soft skills' of international communication and collaboration. As early career researchers are typically more mobile, contacts and links developed at this stage lead to new collaborations that can last for decades and be of major relevance for research topics and careers.

Successful collaborations have positive impacts on research careers and future collaborations. An emeritus professor explains that earlier international collaboration focusing on research training 'certainly helped to get young people more rapidly in international reputation and eventually a professorship' and thus enabled the renewal of collaboration with a young generation of scientists. A project leader who was trained in a

long-term international collaboration lasting more than 20 years explains that scientists who are currently Principal Investigators in this network:

'used to be PhD students or early Post Docs. We got full professorship and we are now driving the action and most of those Principal Investigators [in the projects in 1990s] they are now retired. […] If one looks at what we were doing 12 years ago and what we are doing now, there is a big change. […] We are lucky […] in our career and continue collaborating and interact [in the new common project that] was not build up on the spot, it was something that was a continuation of an endeavour that lasted decade and more than decade.'

He emphasizes how important their early socialization in the international network has been for the successful continuation of collaboration:

'We did not suffer from this new change of generation probably because we were educated, we were trained, raised ourselves already within this kind of European project, European collaboration, and we knew already how to interact with each other, and so we were ready to lead a scene after these older people retired.'

However, not all early career researchers receive the same support and encouragement. Participants of international networks notice how differently young researchers are treated in different countries and institutions. During his exchange visit to another country, a PhD researcher in a Marie Curie training network observed that his collaborators received much less support from their supervisors:

'in our university [...] I am very happy with supervisors and promoters because whatever you want to do we have a freedom to do and they will encourage your ideas. That kind of thing if you want to go to conference or if you want to go to secondments, if you want to learn something – our supervisors they are not stopping us because they want to see us as individual researchers at the end of the day. I like that kind of attitude. But I don't see the same thing in other universities [...] I don't see that kind of support from supervisors for PhD students. But when I speak to other people in our university I got the same – everybody had a freedom to do whatever they liked related to project and they had their own ideas and supervisors they are very cooperative.'

Other PhDs who had an opportunity to visit collaborative laboratories in other countries also noticed national differences in the way PhD researchers were treated. A PhD researcher from Germany doing her PhD in the United Kingdom visited a laboratory in France and reflected that, according to her experience:

'*France was probably most different because it is a very strong hierarchy so that supervisors would pretty much tell the students what to do and control it very, very closely. So that is a bit more like undergrad students rather than independent researchers, while here [UK] and in Germany you are very independent. The supervisor just makes sure that you are actually doing something. But you kind of had your own ideas, you come up with experiments and they will just have a look if it is ok. So there is much more control in France.'*

The same researcher also compared her impressions on the treatment of PhD researchers in Germany and the UK, saying that:

'in Germany they respect PhD students more, I have to say that. It is kind of as a PhD student you are already like a proper researcher, like post, not the same level, but the same kind of… it is a big step from a student to PhD whereas here [UK] PhD students are basically student and then there is a huge step to a Post Doc. So sometimes I found kind of a bit annoying that I was kind of… I do not know, I would not say not treated with respect but… how could I say that… they would trust you much more in Germany that you kind of know what you are doing and are able to work independently and they would also take your opinion into account that is why I said you can have good discussions but here [UK] often they think you are PhD, you are not part of scientific discussion as much.'

While EU funding schemes aim to support the training of young researchers, their actual treatment still very much depends on individual group leaders and senior scientists. One group leader tells of his experience in an EU project where some senior scientists were negligent about their training duties and responsibilities:

'There was one meeting for the young people, for the PhD students to complain to the project officer [from the European Commission] if there is anything to complain about, and some did. And afterwards their boss really criticized them very hard because they complained; they should not complain in front of the project officer. That was exactly the opposite from what should happen. He did not train them, he complained when they criticized.'

Conclusions

In contrast to the stereotype that international research collaborations are dominated by senior scientists, empirical data demonstrate that early career researchers often play an important role in these collaborations. Some of these networks were launched by PhD candidates and Post Docs. Early career researchers play an active role in designing collaborative experiments, doing them jointly while visiting one other and writing co-authored papers. While the overall trend confirmed by senior researchers with long-term experience of such networks is towards an increasing role of early career researchers, considerable differences in their status across countries, institutes and collaborations persist.

Early career researchers doing their PhDs and Post Docs within European collaborations not only experience the benefits of additional support, network and motivation but also the challenges of project pressures, hierarchy and sometimes limited engagement of senior scientists. Successful and productive research collaborations are typically characterized by an active role and empowerment of early career researchers who, in the long-term, can contribute to the further growth of the collaboration and respective research field, i.e. the 'virtuous circle' of international research collaboration (Ulnicane 2015) where the success of earlier collaboration (e.g. training) leads to the renewal and continuity of productive collaborations.

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