The global competition for talent: Life science and biotech careers, international mobility, and competitiveness

Kuvik, A.N.

Publication date
2015

Document Version
Final published version

CONCLUSIONS

"Forget terrorism and weapons of mass destruction. The next global war will be fought over human capital." (Heenan, 2005 p.1)

This study examined what the global competition currently means, by discussing theories for skilled migration and competitiveness, statistical changes in skilled migration and international mobility, policy changes related to international mobility in the EU, and through examining careers in a growing field, biotechnology and life sciences in various countries. While this study has begun to answer the question, "What is the global competition for talent," perhaps a bigger question is "What will the global competition for talent become?" While the answers can only be speculative, current trends and past experiences offer some insights, while a review of the existing research illuminates some theoretical and empirical gaps.

The 1990s to early 2000s was clearly an important turning point in skilled migration polices in many countries and in media and policy discussions across the world and a basis was built for discussing a "global competition for talent". Although skilled migration was common in earlier decades, the movements were less influenced by specific national policies, but were largely seen as occurring as internal mobility in companies and particularly of managers in multinational corporations. Such movements were seen as unproblematic by governments in advanced countries and did not receive much policy attention. However, the IT boom in the US and in the case of Europe, the desire to emulate this success (as indicated by the goals of the Lisbon Agenda), triggered discussions of 'competitiveness' and in growing the knowledge economy. By the mid-1990s, discussions of 'competitiveness' had become part of the immigration discourse in Europe as more countries aimed to move from restrictive systems to selective systems of migration, favoring (temporary) skilled migration and also trying to further advance the attractiveness of the university system and higher education for foreign students. Although policies and trends will continue to change due to the current financial crisis and changing economic needs in general, the past forms an important backdrop for assessing the attitudes, beliefs, and experiences that have influenced policy decisions and mobility to date.

Given the economic trends seen in both developing and developed countries, interest in the global competition for talent will likely grow. Within this broad grouping, biotechnology whispers of potential solutions for the most pressing global problems – improving food production, alternative energy sources, pollution and waste treatment, and more affordable and efficient procedures and treatments in health care with fewer side effects. It therefore is a sector that fits the model of the "knowledge economy" and is expected to be part of economic cornerstone of advanced economies' competitiveness as well as important to emerging and even developing markets. According to the OECD, biotechnology is "the application of science and technology to living organisms, as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services." Biotechnology has become the

cornerstone of current life science research. The most developed area of biotechnology in Europe is for healthcare technologies. Although the biotechnology sector does not always have large numbers of employees, it is a research-intensive field and makes a strong contribution to innovation (whether assessed by publications or patents). Therefore, supporting biotechnology is often part of the economic competitiveness strategy in both developing and developed countries. Regulatory climates for the biotech industry vary from place to place, as seen for example by varying support for stem cell research or bans on genetically modified food. The development of the biotechnology sector and the shape of it, in terms of specializations and its relative strength in industry versus academia, is influenced by a wide array of policies, research budgets, and any range of local to international partnerships.

One aspect that remains constant is the knowledge-intensive nature of the industry, which crucially points to the importance of aspects related to the availability of qualified personnel. There is a strong acceptance by policy makers that countries are increasingly becoming, 'knowledge' economies and that R&D intense activities, such as those found in biotech, are crucial for preserving national competitiveness in light of possibilities for lower cost manufacturing in other countries. Furthermore, there is a sense that there is not only competition to keep businesses located within their territories, but also that there is intense global competition for the best employees. However, the so-called "race for global talent," or "battle of the brains," overstates the openness of national labor markets. Despite the explicit focus on 'knowledge' little research has been done to understand how policies support or confine the availability of personnel, and related to this point, the recruitment practices, barriers, and skills shortages faced by businesses, or the impact of individual preferences regarding working in various countries or biotech regions.

RESEARCH QUESTIONS

This study set out with a primary goal to examine: **What structures the global competition for talent?** This is a question that arises from the observation that concern about the global competition for talent is increasing – in academic research, in policy reports and in media – and globally. Yet, it is not always clear what is meant by this phrase.

The research in this study is exploratory, in that its primary aims are to add new details to understand an emerging phenomenon, and one that still requires more theoretical development. In order to advance understanding of this topic, this study set a number of sub-questions to better examine the context in which the global competition for talent occurs. Part I of this study addressed conceptual and structural aspects:

- How can concepts and data (policies, statistics detailing changes) related to skilled migration and competitiveness be linked to better understand the global competition for talent?
- How have skilled migration policies and other policies facilitating international mobility of students and scientists developed in Europe? What are the main features of these policies within the European Union?

Part II then analyzes: **Which patterns have influenced the development of the global competition for talent as observed in the life sciences/biotechnology in particular?**

The main focus is to address the research question primarily from the viewpoint of the scientists, rather than from the employer or policies:

- How important/prominent is international mobility in life science careers?
- Which factors are considered and influence life scientists' intentions to move or moves abroad?
- Which countries are attractive to life scientists and why?
- Which duration of stay is most desired for moves for life science jobs in the US and in Europe?
- What effect do life scientists expect international mobility to have, in terms of staying abroad or returning to their home country to work?

This part also briefly examines a few structural aspects that are important for understanding the context in which international mobility occurs for the life sciences in particular:

- What are the features of the labor market within which life scientists work?
- Which cities and countries are seen as the most competitive for biotechnology globally?

These questions have been addressed one by one in the preceding chapters. The goal here will not be to summarize each but instead to point to how they act together, by better integrating the findings into the analytical framework created for this study and described again below.

THEORETICAL LENS: MERGING RESEARCH ON COMPETITIVENESS AND IMMIGRATION

The main goals of this study relate to better understanding the global competition for talent, both as a concept and through better understanding new career dynamics. Various theoretical foundations are implicit in discussions of the global competition for talent.

One of the most important theoretical perspectives is the work on the drivers of *competitiveness among countries*. Competitiveness is not a simple competition, but rather made up of assessing strengths and weaknesses. The concept of competitiveness has been advanced through the work of Porter (1990; 1998; 2003). Porter argues that the share of exports was often used to measure the competitiveness of countries, as it showed the products that were in demand internationally, but the advance of the knowledge economy has made this inadequate. It is not just tangible products and trade that are now linked with productivity and the relative performance of countries, but increasingly technology to improve or even create new products or processes and the knowledge held by individuals as well. He argues that the competitiveness of countries is best measured through *productivity*, defined as "value of the output produced by a unit of labor or capital" (Porter, 1990, p.6), and with attention turned to individual industries to see the underlying drivers of productivity. Porter argues that high productivity allows both for higher wage levels and higher living standards. In addition, in order to build

competitiveness, countries need to build specializations, to focus on the industries where their productivity is highest. He argues that this can be accomplished in part through creating and promoting industry or research clusters, consisting of regions where universities, companies and other institutions create a synergistic environment where ideas can be exchanged and developed. Porter (1990) hence argues that examining macro-economic competitiveness, paradoxically, is best done through looking at the issue from a different scale, that of industries and regions.

Drucker (1986; 1999) began discussions on the importance of the *knowledge worker* to economic success. Drucker's work was also a response to the rising challenges and changes of the knowledge economy. However, his focus on the knowledge worker pointed out that the individual level is also important to productivity. Individuals successfully working in the knowledge economy need to have the motivation to update their skills and also to produce quality work, not just quantity. In the knowledge economy, it is these personal characteristics of the individual knowledge workers that most influence the productivity of the organizations in which they work.

The literature on the knowledge economy has expanded considerably, but what is still difficult to measure is what I refer to as the workforce dimensions of competitiveness, which has become of central importance. In part, this is related to human capital, or the skills and knowledge that individuals embody. This aspect is measured to some degree in competitiveness reports, often through the number of graduates in a given field or the number of researchers. However, data for the scientific workforce as a whole is often not available and not comparable across countries. Knowledge can be measured through statistics on patents and publications, but what is missing is how this fits together in regards to differences in employment or career contexts.

In Chapter 2, it was argued that in the 2000s there was an increasing recognition of *immigration* as a contributor to national or regional competitiveness. Skilled migration policies were implemented in more countries, where they had not existed before, and new attention was also turned to student migration. Skilled migration has generally been studied from the same theoretical perspectives used for other forms of labor migration, including push-pull models, examination of global systems, and network theories.

More recently, skilled migration has been linked to the concept of 'talent.' This perspective has been built in part from the influential work of Florida (2002; 2005). Florida argues that regional growth can be better understood through technology, talent, and tolerance, the 3Ts. Florida (2002, p.249) argues, "*To attract creative people, generate innovation and stimulate economic growth, a place must have all three*." His research focuses on the creative class, which he defines as various creative occupations, researchers, and other skilled work. His research originally used data on urban areas in the US. Florida's work has been very influential and has been important in the expanding interest of 'talent' as well as in increasing the (political) acceptance that immigration can be an important contributor to economic competitiveness. One of his central arguments is that tolerant and diverse environments are a necessary condition to attract creative individuals, who are the drivers of creating innovation, which then creates regional growth. Yet, the degree to which it applies to contexts other than the US has been

questioned. A new framework for understanding the global competition for talent is needed, which can better apply to other countries and contexts.

Advancing competitiveness has become a top policy priority and is used not only for economic policies, but also to argue in favor of skilled migration, for instance, and as further internationalization of education systems, research and science on the whole occurs. 'Talent' has become an essential economic concern– *"Talent – what it is, how to grow it, how to keep it, where it exists and how to attract it – has become a preoccupation for developed and emerging economies, as well as many developing ones, because it lies at the heart of economic growth and competitiveness" (Papademetriou et al., 2009, p. 215)*.

Yet, as pointed out in the quote above about talent, there is no consensus yet as to what 'talent' means. Like competitiveness, it is not always clear what scale it should be measured on, and the concept of 'talent' has taken root both in the management literature, that is how companies can develop, attract and retain 'talent',' as well as in discussions on national skilled migration policies. Even when limiting the discussion to its application to immigration policy, it can be defined broadly as individuals with specific skills and abilities, or from educational fields where there is an assumed demand or those seen as strategic for supporting national competitiveness. It can also be analyzed more narrowly, whereby talent is used to attract only the top individuals in a given field, which can range from top athletes, to artists, to star scientists, to name a few.

In Chapter 2, I presented the main theoretical lenses that I see emerging in discussions of skilled migration in Europe. These are reiterated here, as they influence the theoretical lens adopted in this study:

1. Skilled migration is presented as a 'race' or 'competition' for global talent or a 'battle for the brains' – Goal of 'attracting' skilled migrants, particularly for the knowledge economy
2. Skilled migration as a contributor to economic and human capital development – Promoting circular migration to mitigate the brain drain in developing (sending) countries, especially in healthcare and education sectors; knowledge transfer to the home country is a benefit of skilled migration for scientific and technological sectors.

Both of these perspectives are implied in research that aims to address the "global competition for talent, the central topic of my study. However, while this phrase has permeated media and policy discussions, it has not yet been fully developed theoretically or empirically. In other words, there have been many assumptions made that lead to conclusions of certain countries 'winning' and other 'losing, without deciding clearly who or what is on the playing field.

The theoretical perspective taken in this study therefore acknowledges that building a strong knowledge economy, in any form, invites questions on workforce availability. These can be filled either externally, by opening labor markets further to foreigners, or internally, by improving awareness of core issues, educational programs, and facilities in growing fields, such as biotechnology. Yet, it also recognizes that past research and theoretical perspectives have been either tainted by incomplete data, such as the lack of

that on the scientific workforce, or by lack of attention to the changing global context. This study aims to remedy these problems by introducing a new analytical framework, consisting of people, place, productivity, and policy (4P framework), which applies to research on the global competition for talent in any country or sector of employment within the knowledge economy. The 4P framework is influenced by the work of Richard Florida, but it expands it further to capture more diverse contexts, whether for different industries within the knowledge economy, or for countries with various degrees of economic development.

To reiterate, the building blocks of the 4P analytical framework include topics where discussion of the global competition for talent is relevant:

- **Productivity** in this framework is linked specifically to competitiveness, which has been defined in this study as status as a leader. This is a simplified definition, but allows for an examination of productivity as it applies to individuals, institutions, sectors of employment as well as countries on the whole. The goal of understanding productivity in this framework is not necessarily to measure it, but rather to better understand how it is related with the other aspects of the framework.
- The category of **'People'** can be based on a number of analytic points:
    - demand for high-skilled labor in general or in a certain occupation/industry;
    - assessing individual merit and excellence, an instance where talent is defined more narrowly
    - the individual determinants of migration, that is what influences individuals to move and which destinations they select
- **(Perceptions of) Place**
    - Country and city image
    - Quality of life and lifestyle
    - The influence of the opportunity structure on working conditions and professional opportunities
- **Policy** can also influence the global competition for talent. Immigration policy is only one of the various areas that create differences among various countries. For instance, as discussed in Chapter 2, Eggers and Hagel (2012) suggest a need to understand 'talent competitiveness' which builds from policies for not only immigration policy, but also skills and education; innovation, research and development policies; and competitiveness in international markets, including foreign direct investment and intellectual property law. Furthermore, as discussed by Reiner (2010) it is recognized that policies can occur on various scales, including the global level (for instance the WTO), supranational level (as seen in the European Union), national level, and regional level. I would like to add that even the policies or common practices of specific institutions, including universities and companies, can have an influence.

The 4P framework adds a number of new aspects that previous work on the global competition for talent could not address – it is relevant for both developing and developed countries. It also works to better combine theories on both immigration and competitiveness, to understand new and emerging dynamics, while still allowing for

examination of the influence of past migration, for instance, or industry path dependencies.

METHODS

Part I is designed to better understand skilled migration in global context more generally, answering the question on what structures the global competition for talent. With this goal in mind, it is built primarily from desk research, including reviews of academic literature on skilled and student migration, statistical data on international mobility, and a review of policy documents, particularly those focused on comparing migration and mobility in Europe.

Part II turns to the topic of scientific mobility, through the specific example of life scientists. It looks at more detail at the dynamics of the global competition for talent as observed in the life sciences and biotechnology. In addition to desk research, the analysis in Part II is constructed particularly from the CiLS survey. I designed the CiLS study, working together with a few individuals from the Young European Biotech Network (YEBN). YEBN is an umbrella organization, made up of various other organizations, largely biotech student associations, in various countries in Europe. The largest groups of members are found in Germany, Switzerland, Poland, Spain and Italy, as these are countries where national student biotech organizations are part of YEBN as institutional members. The survey was conducted online in late 2008-early 2009. It was announced in various ways: among YEBN members and in different associated newsletters, in emails that could be forwarded to individual YEBN members' contacts, by articles in academic biotechnology journals, and through a link to the survey on one of the largest international life science job websites, Naturejobs.com, which is related to *Nature*, one of the most prestigious life science publications. The number of responses from each of these collectors is found in Appendix A.

The CiLS study was presented as a survey about science careers, and international mobility was not a screening criterion, or in other words, was not required. Instead, respondents were screened on either currently studying or already having a degree in the life sciences or having already worked in a life science job or internship. As the survey was designed as an exploratory study to look at new patterns in life science careers and international mobility, it was very detailed, containing 121 questions, some of which involved multiple statements and rating scales. The goal was to get international data on life scientists from understudied countries and new information on current dynamics of international mobility, rather than a high number of responses. It was also designed to be a springboard for further research on life scientists' careers and their international mobility. The survey was completed by 594 individuals, including both students and those working in the life sciences or related fields. The responses came from 69 countries, with the largest number of responses from the countries where YEBN is strongest as well as from India, the country that had the most responses to the Naturejobs survey link (34% of responses from this source were from India).

Participant observation also allowed the data and analysis to develop. Notably, I was actively involved in the Young European Biotech Network, attending in-person team meetings for the Careers in Life Science project, the YEBN annual meetings, and either

personally presenting the results of the CiLS survey, or helping to prepare presentations for others, at both internal YEBN meetings and organized life science career conferences. This allowed me to have greater understanding of life scientists and their concerns and provided feedback on the preliminary results of the CiLS study. A second aspect of participant observation occurred as I lived as an internationally mobile individual, as an American citizen living in four different European countries while working on this study. While this did not strongly influence the primary data collection, it exposed me to contextual differences that likely had a broader influence on my analysis of factors influencing international mobility and the aspects that need to be developed to better understand the global competition for talent.

PRODUCTIVITY, PEOPLE, PLACE, AND POLICY FRAMEWORK AS APPLIED TO LIFE SCIENCE CAREERS

The following sections will look at each of the aspects of the analytical framework – people, place, productivity, and policy – as revealed through this study focusing on international mobility of life scientists. Each section contains a reflection on some key findings on each of these aspects, to better understand how they can apply to careers of life scientists and their international mobility decisions. This is not to say that immigration or scientific mobility is the only way to improve the amount or quality of 'talent,' but rather it gives a more in-depth look at the influence of this one route to address issues related to 'talent'. While many contextual features will vary across countries, the 'most competitive' economies will likely have managed to successfully intertwine all the aspects of the analytical framework – productivity, people, place, and policy. The strategy taken and the results of how each is performed will clearly vary across countries. However, it is also my perspective that 'success' can only be measured as a single point in time, as global dynamics continue to change, as regulation shifts, as new companies emerge or old ones fail, as innovative technology replaces older processes or topics of scientific research, and as countries develop, to name a few.

Productivity

The economic importance of the knowledge economy in the past decade has been demonstrated in statistics. Under this larger umbrella of a 'knowledge economy,' the life sciences and biotechnology have been growing in their relative size and importance. Indications include:

- Rising R&D and life science strength in developing economies, offering both a further source of competition and international collaboration for advanced economies
- Relative importance of sectors such as pharmaceuticals and chemicals, fields which also can be tied with goals and tools of biotechnology, in Europe.

Given these changes, competitiveness has become a crucial concept in understanding and supporting the knowledge economy, but measuring competitiveness is forged with many difficulties. One of the major problems is the lack of comparable data to measure various aspects of competitiveness that are linked with the workforce dimension. There are also problems to properly account for effects of internationalization. The effects of

international markets are hard to define, measure, and assess and taking a view of 'national' competition may analytically counteract the assessment of these synergies. Life science research involves a large degree of internationalization and through a range of forms, including international mobility of scientists in various career stages and for various durations, and international research projects with teams in diverse countries.

As was shown in the theoretical framework, productivity is important not only on a macro-level and among countries, but also among individuals. The presence of individual, 'star' scientists (see e.g. Trippl, 2013; Zucker & Darby, 2006; Zucker & Darby, 2007) have been found in other research to have an important role on the scientific productivity of the region where they reside. This is a result of both their own innovation contributions, including in the form of publications or patents, and because their presence can attract other talented scientists. This points out to the importance of the individual in the global competition for talent, and again shows that understanding 'talent' as defined narrowly by personal characteristics is important as well as understanding employment areas and skills in demand on a broader scale.

After better understanding the general context in which interest in the global competition for talent is emerging, the study turned to examine structural aspects specific to life scientists in particular. It was argued that life science careers now take a very different form than before, and one that the life scientists' may not be anticipating. First of all, with the growth of the knowledge economy, there is an increasing role of research done by companies, or within industry, rather than academic research. Academic research has been seen as the ideal path among scientists, and their training has traditionally been geared toward conducting research for publication. The work in companies usually is driven more by products, and patenting, although some companies allow their employees to publish, in part because they realize it is important to the individual. At the same time, academic research in many advanced countries like the US and UK are increasingly involving short-term, insecure work, such as through post-doctoral positions. Few tenured positions are available. This means that although life science researchers may have high human capital, a PhD degree or more, they are not necessarily benefiting from higher pay or better positions. Of course, the structure of employment and the conditions vary by country, but the main trend is that the type of jobs available has changed.

Demand for scientists is also difficult to predict, as the relative importance of different research specializations change based on new technology and findings, and new biotech companies seem to rapidly open, as well as close. Given the insecurity, usually scientists who want to work in industry are most interested in the large, prestigious international organizations and companies. This is likely due both to stability as well as the type of opportunities and work these organizations offer. SMEs have low appeal, among the scientists in the CiLS survey.

Another aspect of productivity in the theoretical framework is related to the development and presence of clusters, strong regions in one economic sector. From the example of biotech, it seems that very few clusters are recognized by individuals in this field; in the CiLS study, the most recognized biotech clusters were only named by around 15% of the sample. These include the area around Boston and clusters in California in the US, London in the UK, and Basel, Switzerland. The US and Germany had several

recognizable biotech clusters, which is one form of evidence of their strength in biotechnology.

People

The main goal of the topic of 'people' is to better understand the workforce dimensions of competitiveness in the selected area of employment, the life sciences and biotechnology. On one hand, this involves understanding the human capital and demographic characteristics of the global workforce, and particularly how these have changed. On the other hand it involves understanding the workforce' motivations, as this is crucial to facilitating the productivity of the individual.

What can be said of the changing trends in human capital and demographic characteristics, as related to employment within the global competition for talent? While in the past, international transferees were associated with a few countries, such as the US, Japan, or parts of Europe, and primarily found in managerial positions or those needing high levels of expertise, the 'new' landscape will include people from a much wider range of countries moving in all stages of the career ladder and in various professions. These moves are also occurring on one hand to places recognized as leaders in the given field, and on the other hand to anywhere where the business or organizational linkages exist. There is also evidence that international moves are more often initiated by the individual and their preferences, rather than the employer 'sending' them on international assignments (Al Ariss, 2010; Andresen, Al Ariss, & Walther, 2012; Doherty, Richardson, Thorn, Al Ariss, & Crowley-Henry, 2013; Vaiman & Haslberger, 2013).

Not only are patterns of employment changing, but international education is also growing in two ways. First of all, the number of people with a Bachelor's degree or higher is also increasing, and particularly within 'emerging' economies (Eastern Europe, India, China, Brazil). Second, there are also increasing numbers of international students and this has implications for both developing and developed countries. The trend of studying abroad can be seen as changing one's individual human capital, since skills and credentials acquired abroad can be different from those available in their home country. International student mobility can also be a route to access labor markets abroad, whereby more international students equates to a more international workforce in those countries. Given that many countries in Europe have implemented a skilled migration policy relatively recently (since the 2000s or later), the changes in student mobility are part of the shift that reflects more openness to allow more mobility of skilled individuals, even when it is only in the form of shorter-term student mobility and not for employment.

These changes have led the topic of the global competition for talent to have relevance for both developed and developing economies, as well as for both established and emerging sectors of employment within those economies.

Important demographic changes are also seen in the life sciences, through data on students and the workforce. These changes are not marginal – there are several important changes regarding the 'new' characteristics of the scientific workforce. First, it has been found that scientific careers tend to have a low appeal in many advanced economies (Sjoberg & Schreiner, 2010), while they are held in high regard by those in 'emerging' or developing economies. This trend points to a likelihood that scientists from so-called

'periphery' countries (in global systems theory) may make up the 'core' of the knowledge economy and productivity aspects listed above, particularly if future trends follow the current course. Second, although science has long been seen as a man's world, statistics and this research show nearly equal numbers of males and females studying life scientists in many countries, including in Europe, and in some countries, females outnumber male doctorate candidates (for instance, in Sweden). Although the senior positions, to date, are still held mostly by men, in time it looks as though this gender imbalance may change. There is a need to better understand relationships between gender and life science careers and to recognize and address concerns of female scientists. Third, as science becomes more internationalized, having experience abroad is seen as part of the career path, whether the individual is from a country or university that is highly competitive in the life sciences or whether they are from a developing or developed country. This trend was revealed for life scientists who partook in this study. Among the total sample, the rates of having already lived abroad for three months or longer was 58% of individuals with a Bachelor's or Master's degree, 69% of individuals with a PhD, and 85% of those with a post-doctorate degree.

International mobility is seen as a way to advance one's research skills and credentials, often for both scientists in developing as well as in developed countries. It is also seen as important for building 'soft' skills and for personal development, particularly open-mindedness that indirectly allows for new research perspectives and is highly valued, or even required, by many employers. International mobility is also a way to build networks for further research projects. It is often a way to access better research labs and equipment, whether for individuals from developing countries, or for people with niche specializations to go to the 'hubs' for their research field. Furthermore, some scientists note that as science tackles problems of global importance, being able to take a global perspective is necessary.

However, it cannot be assumed that life scientists are aiming for long stays in the countries they move to. The CiLS research showed that 1-3 years was the most desirable length of stay for life science work, whether in academia or industry, in either the US or a European country. In this context, the previous paradigms of brain drain versus brain gain are problematic, as multiple moves are likely after an initial period of international mobility, whether back to the home country or to a new destination.

(Perceptions of) Place

In the CiLS study, the reasons for choosing a destination provide evidence on how the perceptions of places may influence migration destination choice. This was done first through a rating scale of various statements about what is considered when choosing a destination to move to. Further info was added through an open-ended question, where the life scientists explained why the given country would be his/her first choice country to move for work in the life sciences. This means that the broader concept of place attractiveness can be examined, regardless of the country chosen.

First of all, the results show that productivity or competitiveness is a clear driver of location choice. The research infrastructure, in terms of equipment and strong research in one's field, attract many individuals, as does a strong scientific work culture. Unsurprisingly, people are drawn to places where they feel they will have opportunities.

Salary is generally not the main driver for life scientists, who instead are driven by being able to produce strong research and improve their skills and qualifications as a researcher. Second, diversity and openness clearly matter strongly in professional work decisions. In other words, general discourse around openness and the reception to foreigners will be important on how 'attractive' countries can be and how likely people will be willing to stay to work there after finishing their studies. Diversity and openness matter not only because they create atmospheres that many individuals find attractive, but also because they are more likely to afford equal opportunities and hence better chances of career advancement.

Third, it is not only the career aspects that matter but also the perceived quality of life at that location, the perceived lifestyle there, and the individual's assessment of how easy it will be for them to adjust there. For some individuals, having family or friends close by is an important part of this adjustment, but many others feel it is less important since new friendships will form after moving. The proximity to the home country is an important driver for many people, and means that other European countries are often the most attractive destinations for European scientists. Language also matters, but some individuals want to move to places where they are already fluent in the language, while others wish to build language skills.

What was found in terms of the actual destination choices? The US, Germany, the UK and Switzerland all emerge in the CiLS study as leading destinations, and have global pull, meaning they are attractive to individuals from outside of the general region. This is linked in part to the size of the life science sector and the performance of its universities and companies in this regard. The US is typically considered the most competitive country in biotechnology and this was also reflected in the CiLS survey results. The US is the top destination of interest for the CiLS respondents, but it did not have a strong lead (as it was only named by 18% of CiLS respondents as first choice). Although the highest levels of interest among life scientists surveyed were for working in the US, most intend to move there temporarily. Interestingly, among the CiLS sample, usually there was more interest in longer stays for work in European countries. The US is seen as an important destination for building skills, learning new ways of researching, and often as a good credential on one's CV/resume.

Germany was shown to be a leader in attracting life scientists. Germany has a very strong scientific reputation, has been seen as open to international students (which was evident in its high levels of attractiveness to Indian citizens), has had active policy support to build new biotech clusters, and also has been involved in international collaborations, which has given life scientists a personal, and positive view of scientists in Germany.

Policy

The findings regarding the structural aspects of the global competition for talent are examined in Part I. As the policy aspect overlaps a great deal with the other aspects of the framework, a few of the main trends will be only briefly highlighted. First of all, new policies for student migration have led to new trends, of movements among and between developing and developed countries. The increases in student migration policies are not necessarily reflective of national changes, but also of institutional changes. For instance, universities in many countries now use higher fees for foreign students as a way to

increase the money in their education systems. Second, as described in Chapter 4, following the increasing interest in competitiveness, more countries began skilled migration policies by the 2000s. Skilled labor migration has previously been relatively small in most of Europe. In Chapter 4, I argued that a reluctant convergence is occurring in regards to skilled mobility in Europe. Many European countries come from a background of wanting to restrict immigration in recent decades, to now trying to facilitate migration in specific forms, which are thought to be beneficial. This has led to a start of new skilled migration policies in many European countries in the 2000s.

While there is an increase in the amount of national skilled migration programs, there is also increasing mobility due to EU directives that are not explicitly part of migration policy. Importantly, there has been a standardization of European education through the Bologna Process, which facilitates international student mobility. Another Directive that is central to this study is the Researchers' Directive, allowing easier mobility of international researchers to come to and work within the EU. These Directives, which are not part of immigration policy per se, are among the most important policy changes having an impact on the mobility of researchers, and have been made on the supranational level, which then is applied by individual countries in the EU. Globally, these policy changes are of interest, as it aims to make Europe as a whole more competitive for research, rather than having a myriad of different entry criteria in the different member states.

Governments have a central role in the 'global competition for talent', as they are largely responsible both for resources related to education and to possibilities (versus restrictions) on immigration. The protectionist attitudes that guard industries may also carry over to 'protecting' the local worker and boost a call for restrictions on immigration in all forms, including for the highly skilled. When governments choose to enter the global competition for talent, by actively seeking out skilled labor in general or for specific sectors, the policies must be made with the 'people' aspects in mind – an understanding of personal and career goals and patterns in high-growth sectors is important. One issue that is considered to be of central importance is the possibility for the spouse to work there as well. It is important to keep in mind that there are many dual-life science research career households, as well as households where the spouse works in a different career.

ADVANCING THEORY ON THE GLOBAL COMPETITION FOR TALENT

What has become clear in this research project is that the global competition for talent should be seen as more than a buzzword, as it is reflective of new, changing, and increasing, mobility dynamics and global economic paths and concerns. Yet, as a concept, the global competition for talent borrows from other theoretical work, rather than already having its own widely accepted framework.

The theoretical lens taken for this study has involved integrating theories on *competitiveness* and *immigration*, particularly as related to the current discussion about *'talent.'* This perspective was found to be a good starting point, but only a starting point. In other words, weaknesses in applying these theoretical lenses to research on the global competition for talent emerged through empirical study.

The main three theories used relate to the three main themes that frame the interest in the global competition for talent – increasing importance of knowledge workers (Drucker, 1986; 1999), changing assessments of national competitiveness (Porter, 1990; Porter, 1998), and 'technology, tolerance and talent' as contributors to this competitiveness (Florida, 2002; 2005). All three of these theories were all found to still be highly relevant, although an eye needs to be turned to new dynamics and diversity in contexts.

Drucker's observations about the rise of the knowledge worker are very important, although there is still difficulty in fully measuring its effects. Knowledge workers are one of the economic cores of the modern economy, and part of the interest in 'talent' is a new development of how businesses and human resources departments aim to address these concerns. A single individual can have a large impact on competitiveness, and there is a need to be sure organizations are in touch with their aspirations, so that they do not move on elsewhere. While this is a micro-economic example, the same would apply to policies for skilled migration. Governments need to take into consideration the needs of the modern knowledge worker, and take into account that the immigration programs address their core needs and that of their families (when relevant).

Porter's theories on competitiveness are very complex, laid out in several books. His core idea that productivity is the appropriate measure of competitiveness in the modern economy and this idea fits well within new studies related to the global competition for talent. Porter argued that productivity is a good measure because it relates not only to economic output, but also to quality of life. In other words, countries with high productivity also can have higher wages or social benefits and still be competitive. This line of reasoning is also important for understanding the global competition for talent, as scientists' (and likely other skilled and creative individuals) were found to consider both aspects related to the competitiveness, such as in the form of high-quality scientific research and career opportunities there, but also in terms of the perception of quality of life in that country. When productivity is being applied to study the global competition for talent, it needs to be understood that it is not just about the output—the publications, the patents, the number of research graduates, or R&D employees – all of these contribute, but they lack the ability to address the impact of individual preferences and the effect of differences in the opportunity structure in different countries. As also show above, although the workforce is seen as a driver of competitiveness, measuring this influence has not been possible. Instead, competitiveness indexes typically rely on broader counts – the number of individuals working in R&D and the number of graduates (which often is for PhD students as a whole, or for science and engineering and not for specializations). Therefore there are clearly difficulties in measuring this competitiveness, despite the popularity of national competitiveness indexes.

Florida's theory on the creative class likely drew attention to this topic of the global competition for talent. However, his framework of 'technology, talent, and tolerance' does not fully account for the measures of productivity so crucial to understand competitiveness. Analyzing the contributions of 'technology' suggests the concept of innovation, and indirectly point to *one* aspect of productivity, but it is an overly narrow description of it that could lead to misinterpretations. The same can be argued for his portrayal of the importance of 'tolerance' as his work, *The Rise of the Creative Class*, in part focuses on the acceptance of gays in an area, its index as a "melting pot" and the

amount of 'bohemians' (creative individuals). While this is reflective of a type of tolerance or lifestyle choices, it is only one conceptualization of it, and one particular to the US context. Perhaps Florida too recognizes this, as his follow-up work, *The Flight of the Creative Class*, instead measures tolerance based on a values index, that is whether the values are more traditional or secular, and a self-expression index, completely different measures than what he used to examine the United States alone. The CiLS research also showed that diversity and openness matter for location choice, yet it should be questioned whether Florida's measures are the best to assess tolerance, as it can involve a complex relationship between multiple aspects. Many people are drawn to places that openly accept diversity, in a wide range of ethnic, religious and cultural forms, but they also seek diverse places in the hope that they will have equal opportunities there -- whether due to gender or any other characteristic. This form of tolerance happens in part because of diversity, but it also rests in societal attitudes toward the foreigners that are present (as a place can have diverse population, yet not appreciate this aspect) and whether or how institutions try to build inclusiveness among its workforce. A place may have a large foreign population, yet generally look down upon foreigners present. Or, it could have few foreigners residing there, yet treat the ones present as highly valued additions to their society, whether the individual is there for the short or long term.

Florida's framework is also aimed at urban environments. Yet, top research institutes can also be found in smaller cities that do not meet the type of diverse, tolerant, urban environment that Florida describes. Not all people have a desire to live in an urban environment, and countries that lack cosmopolitan cities but instead pride themselves on their beautiful, natural environments, or high-quality of life, for example, can still be highly competitive. Some individuals even seek out places dramatically different from their own country, due to personal interests and the expectation that it will lead to personal growth. Furthermore, fields like biotech research are relevant to both developing and developed countries. A new framework was suggested that is expected to apply to more contexts – the 4P framework. The key will be to mix people, place, productivity and policy in a way that makes them attractive to individuals who would be interested in that destination.

How can theoretical understanding of the relationships between immigration and competitiveness be further advanced? To summarize, a primary barrier is that although elements such as 'knowledge' and 'human capital' are seen to be crucial to modern-day competitiveness as well as to skilled migration, they are not easily measured in a way that keeps the human dimension alive, that is to say to recognize that individuals have their own aspirations and personal as well as career motivations. Human capital is built on an assumption that the values of skills are measurable, but is it really the same for all individuals in any context?

Using specific career contexts as the starting point for examining mobility also may bring about different conclusions as to the value of various skills versus education. One argument that is commonly used against skilled migration in the US, for instance, is that often the recipients are not among the highest in the educational ranks (Matloff, 2008), but rather only hold a Bachelor's degree and moderate salary. Yet, this critique does not take into account whether the individual is in an early or late career stage, and the

education and skills appropriate for the job being filled. For example, post-doctorate positions in the US require very high education, but are considered to be relatively low-paid and insecure jobs. Collett and Zuleeg (2009) argue for the increasing importance of "soft, scarce and super skills" in skilled migration , which require possibilities for more a personal selection of migrants rather than broad lists of qualifications, as is found in most point systems or skilled migration visa programs.

There are a few precautions that should be made while advancing theory related to the global competition for talent. One is that the relevance and importance of competitiveness and competition should be separated within conceptual or theoretical frameworks. There may be a competition for resources, in this case for appropriate employees, occurring. However, there cannot be said to be a competition between countries, in the sense of a type of sports match. Competitiveness instead suggests underlying dynamics and advantages.

Another problem, which is closely tied to the idea of competition, is a tendency to want to name the countries that are 'winners' versus 'losers' in the global competition for talent. In terms of skilled migration, human capital theory and brain drain theory are closely intertwined in research (for a good overview of past research, see Cañibano & Woolley, 2015), even developing around the same time in the 1960s. This intermingling can be problematic, because using the term 'brain drain' can lead to an assumption that a skilled individual, or scientist, who leaves his or her own country, has done something harmful. This critique has been noted in the brain circulation perspective, where it is stated that many skilled individuals return, and with new or better skills or knowledge than before, hence enhancing their country of origin. But what of how international mobility fits into career dynamics? This is where new research on the global competition for talent becomes very interesting and relevant. International mobility has become integrated in the career structure of life scientists in many countries. It therefore cannot just be said that a place aims to 'attract' scientists, but also that scientists aim to make themselves more 'attractive' through international mobility. International mobility therefore is a career 'stepping stone', to use the words applied in the CiLS survey, and the individual is stepping toward a research career, and often one they could foresee taking place in any of a number of countries. Life science research often aims to tackle problems of global importance – improved healthcare, environmental sustainability, improving food supply. Many scientists are influenced by altruistic motives as well as a strong sense of curiosity. They recognize that solving global problems will require a broad, open-mind, and international mobility is seen as building these perspectives. In many countries, international mobility is seen as critical for life science careers, to build new skills and/or for international collaboration and networks. Many individuals, who are not necessarily personally highly attracted to the idea of moving internationally, see it is as essential to their career. Life scientist, particularly in continental Europe (given that the CiLS data suggests that the US and UK are exceptions) and many developing countries, say it is often a requirement for academic jobs in their home country, and also valued by companies.

Expressing the increasing integration of international mobility within life science career paths does not imply that the brain drain perspective is necessarily wrong—We can expect that brain drain can be occurring in some contexts, particularly where the sector of

study is too underdeveloped to have viable employment options or when there are barriers within the opportunity structure, including non-competitive hiring practices or discrimination, for example, to access these jobs. But in the context where the sector is present, assuming 'brain drain' ignores the importance of international mobility for building both skills and contacts. It also ignores that science is increasingly international, both as the topics address issues of global concern and as research is conducted in multiple countries. The discussions of scientific mobility instead points out that brain drain discussion is problematic from its basic premise that moves are in a model of going to one place and staying, or at some point returning home. It is further problematic in that the *outcome* is already decided before the processes or motivations involved are assessed. It is sometimes assumed that developing countries have to be in either a pattern of brain drain or brain circulation to thrive, but has this been proven or is it based on historical patterns that have since changed? The perspective of scientific mobility is therefore more appropriate as it looks at stays of any duration and to and from any country, regardless of the level of development.

A second analytical problem is that the 'talent' perspective is still developing and not yet fully defined. In its present stage it allows analysis to focus both on skills as a whole as well as the importance of contributions of individuals, such as 'star' scientists. It should be kept in mind that interest in 'talent' is occurring both in management literature, as well as in topics that take a more macro-economic focus and related to competitiveness. Migration research on the global competition for talent often fits into this second category.

Advancing research and understanding on the global competition for talent would be helpful to remedy this situation, particularly by researching a large range of countries for a more narrow focus on specific sectors of employment or study. The 4P framework of productivity, people, place and policy was found to be relevant and revealed a wide range of new information helpful to better understanding the global competition for talent among life scientists. This approach is need to better fit within the competitiveness perspective, whereby it is argued that specific sectors must be used for discussions of international competitiveness to make sense. This approach also allows both for assessments of various scales, be it a company or a country's ability to 'attract' individuals. And, importantly, it frames this within *global* context. It already assumes that the dynamics of international mobility are changing, and that both developing and developed countries have a crucial position in this change, and that neither its processes nor its effects are completely understood yet. It is not a matter of who 'sends' and who 'receives' the individual necessarily, but rather of how fields such as those in the sciences have both international importance and can be connected by large, international teams or networks. These networks may be made up in part of individuals who 'return,' but also form as science and the issues addressed are global concerns, and a combination of shorter-term visits and conferences, exchange programs, student migration, working abroad, and joint research done in different locations all feed into the network.

The changing dynamics of the so-called 'global competition for talent' also provides challenges for further theoretical developments. Building on the work done in this research, a few challenges have been identified:

1. Challenges related to migration theory, as international mobility becomes more and more fluid, with fewer border restrictions and an active aim to 'attract' certain categories, either those that are needed in local labor markets (shortages of certain professions) or are said to be in top demand globally (wanting to attract the best in these fields). One theoretical idea that will likely become more relevant is that of place attractiveness on the global, regional, and national levels. Empirically, there will be a need to see how and why new patterns of skilled migration or scientific mobility have emerged, where past migration streams would lead to a prediction of different patterns. The talent perspective also embodies discussions of place attractiveness, why one place, whether a country or city, is more attractive to individuals than another. This discussion is closely tied to geographic research, and in this context to economic geography.
2. The challenge of further linking theoretical understandings related to the impact of individual characteristics, qualities, and decision-making with theoretical and empirical frameworks for economic competitiveness.
3. Understandings of the global competition for talent as influenced by employment and welfare trajectories of various countries: Generally the statistical trends show that the global competition for talent is too new and statistics too thin in many European countries to discuss firmly decided 'strategies,' particularly linked to welfare states that set its course in the global competition for talent. Democracy will mean finding a place among potential public resistance, in counteraction with likely support from some businesses.

Competitiveness and immigration, in terms of destination selection, are mutually reinforcing. In other words, the competitiveness of a place has some influence on the destination chosen, and attracting 'talent' through immigration can also boost the attractiveness of these destinations further. There are a range of other studies and findings that relate to this assumption – for instance, the idea of being able to build critical mass of professionals in core clusters and the ideas of Florida which were also confirmed by the CiLS research, that diversity and tolerance increase the attractiveness of a location. Hence, understanding the global competition for talent in the knowledge economy involves both analysis of how competitiveness influences immigration patterns as well as how immigration can influence the competitiveness of the locations where individuals choose to move.