Scientific Diasporas: international or transnational scientific cooperation?
China and its scientific diaspora
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Abstract

This paper deals with what is perceived as a potentially emerging dynamic in the shaping of relations in the global science system: transnational cooperation in research. The paper is primarily conceptual in nature as it presents an attempt to define a new concept and to place it in the broader literature on research collaboration. After a definition of concepts, it discusses a first methodological approach which was used to explore whether the phenomenon existed in the first place and whether it can be shown to have an impact on the dynamics in the global science system. It continues by discussing the potential implications of the findings and the expected future development of this phenomenon in the case of the Chinese science system.

Section 1 Introduction

Over the last two decades the mobility of students and scientists has increased drastically worldwide. China, which had been closed off from the outside world in the preceding decades started opening up in 1978 by sending students and researchers abroad for scientific training to the US and Western Europe. Several years later it also allowed students to go abroad by their own means. Initially a trickle, the flow of students increased over the 1980s and after a dip following restrictive measures taking in the wake of 1989 it continued its exponential rise during the 1990s. The growth in the number of outgoing students have topped off in this decade and in some years even decreased somewhat partially due to incidental events and their aftermath (9/11, SARS). In these years the average annual outflow was around 120-140,000.

The return rate of students and scientists to China was far lower than the Chinese government had initially envisaged. Many students decided to remain and work in their host system (or move on to another) for several years which often became a permanent move. This is the case especially for North America, which was long also the most popular destination region, but to a lesser extent for Western Europe as well. As a result the size of overseas Chinese scientific communities has grown
considerably over the years as will be shown in the section on findings and results.

Overseas Chinese scientists were important in the re-establishment of China’s higher education and research system after the Cultural Revolution. For example they helped to set up graduate training and their advice informed many of the institutional reforms started in the 1980s. Chinese scientists in the US also played an important role in facilitating the inflow of Chinese students during the eighties by setting up an (informal) accreditation mechanism. The Chinese leadership considered overseas scientists to be an important asset: “a brain bank”. Apart from the potential these communities offered when some of its members would return to China, overseas scientists could be important sources of new knowledge, technology, business links, policy-advice, collaborative ties in addition to playing an active role in the Chinese research system itself. During the 1990s, the Chinese government therefore did not only set up programs to promote the return of overseas Chinese scientists but also engaged in a range of activities to further strengthen the ties with its growing scientific diasporas.

Examples of such programs include The Ministry of Education’s Chun Hui program and Program of Academic Short-return for overseas scholars and researchers which sponsor overseas scientists to come to China for short periods to teach or do research and the Natural Science Foundation of China’s “Two Bases program” in which overseas scientists are funded to work in China while maintaining their position and spending most of the year abroad, its Joint Research Fund for Overseas Chinese Young Scholars and the recently established six research group program in which Chinese research teams form a collaborative network with foreign research groups headed by overseas Chinese scientists. Networks of Chinese scientists had started to emerge organically in the US and the formation of similar networks has been actively supported in various other host countries. Internet portals provide another way to actively engage the overseas communities of scientists and students, by providing access to information on opportunities, activities and events in the home and host country (For a discussion of these programs and other sources used for this introduction see among others: (Cao, 2004, Jonkers, 2008b)).

The presence of the Chinese scientific communities in the various partner countries has increased rapidly over time. As will be shown in section 4, in some of the subfields studied in more detail the share of the US’s SCI papers published by researchers with a Chinese surname has more than doubled over the past 15 years. The same period saw a rapidly emerging presence of China in the
global science system. This latter development has made China and increasingly important collaborative partner for science systems in North America, Western Europe, and the Asia Pacific. As discussed in section three, the number of international co-publications has increased rapidly over the past decade as well. Foreign governments have stepped up their efforts to promote scientific ties with China and could be considered to be in a form of competition over these contacts.

Overseas scientists are expected (and will be shown) to be involved in a large share of the international co-publications with China. This may be because they have a larger interest in cooperating and collaborating with their peers in mainland China and as discussed it is actively stimulated by governmental and intermediary organizations in their (former) home country. Other reasons to expect a relatively large role of overseas Chinese scientists is that these actors are expected to possess cultural capital (the clearest example of which may be language skills) as well as social capital (existing contacts with researchers in mainland China) which gives them an advantage over their non-Chinese peers in forging ties with researchers in mainland China.

The central aim of this paper is to discuss whether ties between ethnic Chinese scientists working outside China and their partners in mainland China can (and should potentially) be considered as distinct from international collaboration between scientists more generally. It assumes that the motivations for the formation of such ties, the barriers and stimuli affecting their formation and intensity, as well as the distribution of the potential cognitive/material/reputational investments, outcomes and spillovers at the individual and/or systemic level may differ from other forms of international scientific cooperation.

Section 2 Definition of concepts

Scientific cooperation has been the topic of a large number of studies in the sociology of science. It is an elusive and multi-faceted phenomenon and it is therefore important to start by defining this concept. The (functionalist) Mertonian school of the sociology of science considers scientific praxis as a fundamentally collaborative enterprise as all scientists contribute to the extension and development of the body of scientific knowledge which is a common good. In extremis, scientific cooperation would in this view include most if not all forms of interaction between scientists including the use and citation of each others knowledge claims and even extends to attempts to question or disprove the knowledge claims of scientific peers. Most scholars adopt a narrower conceptualization of scientific cooperation and this will be done in this paper as well.
Scientific cooperation refers to the conscious (and voluntary) exchange of private valued resources between scientists. These valued resources can include research materials, information not yet in the public domain, cognitive resources in the form of advice, criticism, and other inputs, the provision of training both to each other and to each others staff and students, etc. The strongest form of scientific cooperation is defined as research collaboration which refers to the working together on a joint project with the aim of making a joint publication (Katz and Martin, 1997, Laudel, 2001, Wagner, 2004).

Scientific cooperation (including research collaboration) occurs perhaps most frequently between researchers working within the same organization in which case one speaks of intra-organisational cooperation/collaboration. If it takes place between researchers working in separate research organizations one speaks of inter-organizational cooperation/collaboration. Finally when one considers cooperation/collaboration between researchers working in different countries it is common usage to speak of international cooperation/collaboration. In recent years scholars have started to distinguish a further sub-set of international cooperation/collaboration, namely multi-national cooperation/collaboration which involves researchers based in three or more countries. This form of cooperation/collaboration in multi-national scientific networks is said to occur more and more. In parallel to multi-national cooperation/collaboration one could also consider multi-organizational cooperation. In both cases this type of cooperation/collaboration refers to large(r) teams of scientific partners. This subset of cooperation/collaboration is, however, not of specific interest to this paper which aims to explore a different subset of international cooperation/collaboration in more detail.

The term “international cooperation/collaboration” is to some extent problematic, both semantically and conceptually. To start with the semantic issue: “International” means between nations rather than between individual actors in different nations. For this reasons some scholars have tentatively argued for the use of a different terminology. At least in one case an author considered the term “cross-border” or “transnational cooperation/collaboration” more appropriate, but neither she nor her peers have continued to refer to this phenomenon in this way (Wagner, 2002). As will be discussed later in this section, the concept transnational cooperation/collaboration will be defined as having a different meaning following theoretical work outside the realm of the sociology of science.
Conceptually the term international cooperation/collaboration may also be problematic because it can be understood to refer to interactions between actors at various levels of the research system (Wagner, 2004). At the governmental level, governments between two or more countries can make agreements about the conditions under which scientists in their research system are allowed to engage in cooperation and the use of research infrastructure by foreign scientists. As the costs of some of the large research infrastructure can be beyond the means of individual national governments there are numerous examples of multinational research organizations for which the costs of establishment, operation and personnel is shared by several governments (e.g. CERN, EUI, EMBL, ITER). At the intermediary level, organizations such as research councils can make agreements with their foreign counterparts about the provision of institutional support for research collaboration. Actors at the organizational level, that is the management of public sector research organizations and universities, sign memoranda of understanding and contracts which can allow for the cooperation of their scientists, the exchange of scientists and students, the set up of joint infrastructure etc. Finally, international research cooperation/collaboration can refer to the interaction between scientists at the operational level of the research system supported or not by the agreements made at higher levels of the research system. It is the interaction at this operational level of the research system to which international cooperation/collaboration refers in this paper.

As indicated in the introduction the focus of this paper is on a specific subset of cross-border or international cooperation/collaboration, namely the interaction between scientists who have left their home country and those who are currently working there. To refer to this specific phenomenon the concept “transnational cooperation/collaboration” will be used. “Transnationalism” is a concept introduced in the international relations literature by Keohane and Nye (Keohane and Nye, 1970). They argued that ties between actors at other (sub-political) levels than the governmental could be important in shaping the relations between states. Representatives of influential immigrant communities, for example, can influence on the attitude of the government of their host country in political interactions with their (former) home systems. The concept of transnationalism has been picked up and extended in other social science disciplines, such as the migration studies literature. In this literature authors started using the concept concept to refer to cross-border ties beyond the political realm, including for example the role of migrants in the formation of commercial ties. In recent years several authors have begun to explore the formation of transnational innovation networks (spanning parts of two or more national systems) in which overseas, returning and circulating entrepreneurs play an important role (Saxenian, 2002, 2005, Coe, 2003). This paper
discusses a simple extension of this latter literature by considering the emergence of cross border scientific networks in which ethnically Chinese researchers engage with researchers in their former home system (or in the case of 2nd, 3rd or nth generation migrants their ancestral home system).

A final concept which is derived from the transnationalism/migration literature is that of **diasporas**, which refers to communities/networks of (former) migrants and their descendants in a host system who engage in a relatively high degree of interaction with members of their own (ethnic/cultural) group and often maintain in contact with their former home system. The strong connotation which this term invokes to the biblical Jewish Diaspora necessitates some qualifications. First of all the concept ‘diasporas’ refers to migrant communities from countries beyond Ancient Israel (that is one can speak of Chinese, Indian, Russian, Argentinian diasporas etc). Second, even though this is the case for China, they are not necessarily defined by a shared ethnicity but more by a shared culture and/or geographic background. Third they have not necessarily been forced to leave their home country under the threat of physical/political prosecution (even if this can be the case). Fourth, this paper refers to a very specific type of diaspora: namely **scientific diasporas** whose members consist of trained scientists (for a discussion of the concept of scientific diaspora see: (Meyer and Brown, 1999, Meyer, 2001)). One may question whether it is justified to talk about a scientific diasporas considering that scientists and other highly skilled professionals tend to include migrants as well as non-migrants in their professional network and probably have a relatively low positive bias for interacting with members of their ethnic/cultural community. Gaining a better insight in the composition of the professional networks of “overseas scientists” would require more empirical study.

**Section 3 Methodology & data sources**

As discussed in the previous section, scientific cooperation is a broad concept which refers to a wide range of activities. This makes the development of a proxy/indicator that could be used for its measurement difficult. Gaining a detailed insight in the intensity of these various forms of interactions would require data gathered through a survey or in-depth qualitative interviews. For the most intense form of scientific cooperation, research collaboration, there is a proxy which though imperfect has become popular among bibliometricians, namely the study of co-publications. The database most commonly used for bibliometric studies contains information on authors and their addresses which allows for co-publication studies at the individual, organisational, and (inter-)national level. The extensive reliance on this data-source has received considerable criticism over
the years (see e.g. Katz and Martin, 1997 and for a review Glanzel and Schubert, 2004). Among its many limitations is that co-authorship analyses may under- or overvalue the contribution of some researchers. Not all co-authors need to have contributed equally. A potential, though also problematic solution to this problem in some scientific subfields may be found in the name order of the co-authors. Power-relations may lead to the exclusion of inclusion of some authors and co-authorship therefore does not necessarily give an accurate representation of the collaborative partners. What is more, not all contributing authors of a knowledge claim have to have worked together or even know each other. Another issue/choice which is important is whether one chooses to use absolute or relative counts. The argument for relative measures becomes stronger if the average number of authors (and or organisations and countries in which they are based) in publications is large and/or growing. In this study a decision was made to use absolute numbers, i.e. a co-publication by researchers in China and N countries leads to a count of N international co-publications with the N respective countries (in the case of most publications, N is 1 or a low number but hyper-co-publications could have some distorting influence). Then there is the problem of multi-institutional affiliations which can lead to considerable over-estimation of the number of inter-organisational collaboration. According to Katz and Martin (1997) around 15% of the inter-organisational co-publications are in fact caused by one of the co-authors providing two (or more) institutional addresses. Some of these limitations are less important in the use of international co-publications as an indicator for international research collaboration as contributing partners tend to be well represented in this type of publications (the issue of unequal power relations plays less of a role and the same is expected to be true for, among others, the multi-institutional affiliations.

Reliable large scale data about the nationality and/or ethnic background of scientists in North American and Western European research systems is not publicly available. It is believed that some organisations, such as the US NSF, do collect this data in their surveys and it may proof valuable in future studies to attempt to gain access to these records. Other potential sources such as national census data gathered by governmental organisations and collected in comparative data-bases by international organisations like the OECD and the UNESCO tend to miss the level of detail which would be required to do studies of the activities of scientific diasporas, let alone their role in specific subfields of science. The possibility to study specific scientific subfields is considered important, because as discussed in the previous section the dynamics of various types of interaction between scientists including the levels of intra-, inter-organisational and international cooperation and collaboration strongly varies from scientific subfield to scientific subfield.
For this reason a proxy was developed to gauge the relative size or rather the contribution of scientific diasporas in different host countries using an approach which was initially developed for epidemiological studies (Choi et al., 1993). In recent years bibliometricians have started to adopt this approach as well. In short it involves the collection of a country’s SCI publications which are co-authored by researchers with surnames which are geographically/ethnically distinct. Lists exist of typical Chinese (as well as Indian, Korean etc) surnames and a name search can thus yield a collection of articles co-authored by scientists from Chinese descent. For this study a list of 270 surnames was used which covers over 90% of the Chinese population. For the assessment of the relative contribution of the scientific diaspora in a nation’s publication output using this simple approach it is necessary to exclude international co-publications with the (former) home country. In the case of the identification of the contribution of the Chinese scientific diaspora this would involve the exclusion of co-publications with researchers based in China, Taiwan, and Singapore. The inclusion of these co-publications would lead to an overestimation of the contribution of scientists with a Chinese surname as each of the international co-publications with China, Taiwan and to a lesser extent Singapore would be included. Their exclusion potentially leads to a small under-estimation of the contribution of researchers with a Chinese surname at least if there is indeed a significant influence of Chinese ethnicity on the likelihood of co-publishing with scientists in mainland China. Considering the share of international co-publications with China in the output of any of the Western research systems the effect of this under-estimation is expected to still be limited. What is more, for the specific aim of the analyses that will be discussed the inclusion of this set of articles would lead to a further methodological/logical problem. As may be evident this approach is particularly suitable for assessing the size of the Chinese scientific diaspora because there is so little variation in Chinese surnames. Similar approaches have, however, been adopted to measure the contribution and role of other ethnic groups in the output of Western research systems as well (e.g. (Webster, 2004).

Apart from using this data to show the contribution of the Chinese scientific diaspora in the research output of Western research system it can also be used to explore whether the size of the scientific diaspora has an influence on the number of international co-publications between China and its various partner countries. The data series on which this (and several other proxies) are based are available for each year between 1990 and 2006 for a range of countries and country pairs. This makes it possible to do Cross Series Times Series analyses after making several corrections to the data (Beck and Katz, 1995). This methodological approach is used to explore whether variations in the relative size of the Chinese scientific diaspora can be used to help explain variations in the share
of China’s co-publications with various partner countries (see: Jonkers, 2008a). These analyses provide an indication of the relative increase in importance of transnational collaboration between the Chinese research system and its main partner systems. Some of the main results as well as the results of another recent study are briefly discussed in the next section.

Section 4 Findings

Over the past decade and a half the output of the Chinese research system in terms of publications in international (SCI) journals has increased exponentially (Zhou and Leydesdorff, 2005). The relative impact and visibility, both in terms of publications and citations these publications receive show strong variations across fields. In the plant molecular life sciences for example, one in ten SCI publications is currently published by mainland Chinese authors and these publications receive a similar number of citations as the average article published worldwide. Other molecular life science subfields score far lower on these indicators. For all subfields, the number of international co-publications increased rapidly over time as well. In relative terms the US the importance of North American research systems as collaborative partners (measured in terms of the share of China’s co-publications) have increased in importance at the expense of Western European systems (Jonkers, 2008a). This trend is expected to be related partially to the increasing importance of transnational research collaboration.

The data presented in figure 1 gives an indication of the size of the number of highly skilled individuals born in China in various countries in North America and Northern Europe based on (2000/2001) national census data as collected by the OECD. “Highly skilled” refers to everyone with at tertiary education and is thus not restricted to active scientists. What is more it is not possible to make a distinction between researchers working in different scientific fields on this type of general data.
*The EU-14 figure for Chinese born population with secondary education does not include figures for Germany, Italy and Switzerland but does include Norway. For Italy and Switzerland no figures were available. Specific statistics on Chinese born residents in Germany are not available due to the nature of German census data – the column for Germany shows the number of highly skilled Asian born residents. Over half of the numbers of Chinese born with tertiary education in the USA, Canada and Australia have been naturalised. To a lesser extent the same is true for France (38 %).

For this reason a proxy was developed to gauge the contribution of “ethnically Chinese researchers” in various research systems in specific fields of science. Figure 2 shows how the share of a country/region’s SCI publications in the field of the plant molecular life sciences has evolved over time[1].

Figure 2 Share (%) of plant mol life science publications co-authored by researchers with a Chinese surname(Thomson Scientific ® ISI, 2007 in Jonkers, 2008)

As the figure shows over 30 % of the US’ SCI publications in this subfield is currently co-authored by a researcher with a Chinese surname while this share was around 15 % in 1990. This relative
measure provides a strong indication that the contribution of ethnically Chinese scientists in the US research output has increased considerably. To a (far) lesser extent this increasing contribution holds for the EU17 region as well. Within the EU17 the share of publications co-authored by researchers with a Chinese surname is higher in some countries (e.g. the UK) than in others (e.g. France as shown in the figure or even lower in the case of countries like Italy, Spain, Portugal or Greece). It thus appears justified to deduct on the basis of this figure that the relative size or at least the contribution of the Chinese scientific diaspora in the EU17 is much lower than in the US.

Table 1 presents the result of a series of simple partial correlation analyses aimed at showing the correlation between the annual number of international co-publications between China and 20 countries in Europe, North America and the Asia-Pacific and three factors which were expected to be potential explanatory factors for observed geographical variations. The data underpinning the proxy’s for these potential explanatory factors were all collected on an annual basis for each year between 1990 and 2006. That the size of the research system (for which the proxy X1 denoting a country’s share of the global number of SCI publications in a subfield was used) would be correlated to the number of co-publications with China is far from surprising: a highly visible research system contains a large number of potential collaborative partners for researchers in China, so all other things being equal it is likely that there are more co-publications with this potential partner country than with smaller, less, visible research systems. Over time the number of international co-publications increases, so the significantly positive correlation between the year variable T and the dependent variable was also expected. Of greater interest to the discussion in this paper, however, is the significantly positive (independent) correlation between the proxy used to gauge the size of the Chinese scientific diaspora in the respective partner countries (X2) and the number of international co-publications.

Table 1 Partial Correlation Coefficients of indicators for scientific output, population of overseas Chinese and international co-publications for each year between 1990-2006 in three scientific subfields (Jonkers, 2008).

<table>
<thead>
<tr>
<th>Partial correlation coefficients with the Number of international co-publications with China</th>
<th>Plant mol life sci.</th>
<th>Cell biology</th>
<th>Biophysics</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1. National share of global # of SCI publications</td>
<td>0.535**</td>
<td>0.449**</td>
<td>0.375**</td>
</tr>
<tr>
<td>X2. Nation’s share of publications with Chinese surname</td>
<td>0.362**</td>
<td>0.196**</td>
<td>0.223**</td>
</tr>
<tr>
<td>Year (T)</td>
<td>0.309**</td>
<td>0.214**</td>
<td>0.299**</td>
</tr>
</tbody>
</table>

**Correlation is significant at the 0.001 level (2-tailed). The relationships between these indicators are explored in more depth in a forthcoming paper using
panel data analyses (Jonkers, 2008a). The outcomes of these analyses reveal among others that the explanatory power of the independent variables increases over time. Simple regression analyses of annual data indicate that the relative contribution of variable X2 becomes only consistently significant in the years after the turn of the century. A different forthcoming paper by Jin et al (2007) uses a similar methodology to explore the role of researchers with a Chinese surname in various partner countries in co-authoring international co-publications with China in detail. With the aid of a large team of students this study actually studied the authors of each individual paper, showing that 72 % of the international co-publications between the US and China in the period 2001-2005 had at least one US based author with a Chinese surname. This percentage is considerably lower, though still quite high, for Europe (40% for Germany, 48 % for England and 30% for France). Another highly relevant finding of this study is that an increasing share of the international co-publications between the US and China is made exclusively by researchers with a Chinese surname based in the two countries. In 2001, 30 % of US-China, 12 % of Sino-English, 14.6% of Sino-German and 12% of Sino-French co-publications were of this sort. In 2005 the respective shares were 35%, 18%, 14% and 10%. Especially this growth in the number of international co-publications made exclusively by researchers with a Chinese surname provides a strong indication that the importance of “transnational research collaboration” is becoming an increasingly important characteristic of scientific interaction with China (Jin et al., 2007).

Section 5 Conclusion and Discussion

The increasing importance of transnational research collaboration in mainland China’s scientific ties could potentially have a range of policy implications. First of all, from the perspective of sending as well as host countries it provides a potential qualification to the theories of the brain drain, in this sense that sending countries which have succeeded in building up a research system which has the absorptive capacity to gain from international research collaboration can potentially benefit from the scientific diasporas formed in its partner countries. Overseas scientists may form a bridge between scientists in their (former) home country and their colleagues in their host countries. In addition, provided they have attained independent positions and critical mass in their host country they may engage in exclusive transnational cooperation/collaboration with researchers in their (former) home country. Especially the latter development, the potential rise of transnational scientific cooperation/collaboration may warrant some attention from a policy/strategic as well as from an analytical perspective.
First of all, one may wonder whether partner countries which lack a large (Chinese) scientific community may have lower chances in the development of ties with the emerging Chinese science system. Will the potential emergence of a transnational scientific community between mainland China and North America put the EU-17 at a relative disadvantage in the development of strong scientific (and by extension other such as commercial) ties with China? If so, should this have implications on highly skilled immigration policies or are other approaches to invest in the establishment of ties less costly or more effective and sustainable?

Second, to what extent does the increase in transnational scientific collaboration lead to a change in the distribution of both the costs and the potential gains of research between the participating research system: who bears the costs, who benefits, how and how much? Scientific cooperation is not a zero sum game – all partners may gain, but then again, some may gain more than others. National government may fund scientific research in part because of the cultural value and prestige associated with the furtherance of human knowledge. This, however, is neither the only nor the most important motivation they have for doing so. While the linear relation between basic research, applied research, technological development and innovation may have been superseded by a more complex understanding of the relationship between scientific and socio-economic developments, the potential of scientific research to (eventually) lead to socio-economic and/or defence improvements as well as other externalities including human capital development does still provide a powerful motivation for governments to invest in public R&D.

Even if one does not consider the potential externalities of scientific research, there are clear benefits to an actor for being at the centre of the global science system (this holds for both individual scientists as well as science systems). Central actors tend to have a larger influence on agenda setting than peripheral ones: who defines the (scientific) questions which are relevant, and who decides on which socio-economic gains are potentially important? At a baser level it may also be justified to ask “who reaps how large a share of the potential benefits in terms of IPR or non-protected spill-overs in terms of human capital development, technological development, or policy-insights etc.” Transnational scientific cooperation/collaboration might differ from other forms of international scientific cooperation in terms of the motivations that drive this type of interaction as well as the distribution of the potential gains from this interaction.
The challenges involved in the development of a methodology to study the distribution of benefits between cooperating partners (be it at the individual or systemic level) are formidable. One potential way to approach this issue is through publication and citation analyses. Co-publication analyses alone can yield only a very limited picture of the centrality/influence of actors, especially if they are limited to a single level such as international co-publications. The respective influence in agenda setting and direction of research may also be explored through content and citation analyses. Content analyses could involve qualitative assessments of the output, either on the basis of the text alone or in combination with the consultation of the authors and other experts. It could also involve, or be combined with, a more quantitative approach to the analyses of texts such as key-word, co-word or co-citation analyses.

There are good grounds to question whether it is justified or desirable to make a distinction between the motivations and potential distribution of outcomes of transnational and other forms of international scientific cooperation as proposed in this paper. The myth of the supposed universalistic nature of scientific knowledge is not among them. Even if scientific knowledge claims are considered neutral and even if the attitude of scientists in the evaluation of competing knowledge claims would not be influenced by race, nationality, gender, etc, this does not necessarily imply that extra-scientific motivations do not influence the strategic decisions of individual scientists which like the strategic decisions of other human actors may be influenced by a whole range of factors including economic and idealistic (including patriotic) motivations. It is not far-fetched to consider the potentiality that foreign born scientists retain a desire to contribute to the development of their home country – and most people would consider this both understandable and laudable.

If helping to raise the level of welfare of (over a billion) Chinese citizens would not be enough of a motivation than it is worth considering that the world as a whole is probably better of with a well functioning Chinese research and innovation system. These global benefits may be clearest in fields with a bearing on food supply and the global environment e.g. fuel efficiency. In other fields of science which may potentially have a bearing on defence or industrial performance, competition may become a more central issue in the mind-frame of western policy-makers. As several industrial/military espionage scandals in the US and Europe in recent years indicate, however, not all forms of knowledge transfer by foreign-born scientists to their home country are considered positive by the governments in their host country. At a less dramatic level actors in governmental and intermediary agencies do consider (and have probably always considered) the various potential
distributive issues involved in decisions to allow for and/or sponsor the international cooperative activities of scientists in their research system as well. The increasing economic, political and scientific prowess of major sending countries such as China may or may not lead to a greater sensitivity over the desirability of knowledge flows and the role which scientific mobility and transnational cooperation plays in this process. Western governments may, if transnational cooperation would indeed become increasingly substantial in the future, start to consider to which extent it is in the interest of their population to foot part of the bill for research projects conducted exclusively by foreign nationals in their country in cooperation with their peers in their home country.

The potential risk which such a line of argumentation brings includes the stigmatization of a group of scientists on the basis of ethnicity or nationality is a powerful argument against it. If an awareness of the potentially increasing importance of transnational cooperation was to lead to measures to restrict this type of activity (or even isolationism) this would constitute a loss to global science as well as to national science systems. Too strong an emphasis on the potential risks/costs of transnational cooperation might lead to a disregard of the potential benefits/gains it may bring (e.g. in terms of scientific ties to a science system which can offer increasing material and cognitive resources) as well as a discounting of the vast contribution of foreign born scientists in the research efforts of some countries – which should also be seen in the light of the difficulties many Western countries experience in attracting sufficient numbers of science students from among their own population. Though care should be taken to avoid this development or to risk the appearance of calling for it, it appears highly unlikely that the further study/exploration of the phenomenon of “transnational cooperation” would have such consequences. The issue of patron’s/government’s potential suspicion of the cross border contacts in which scientists engage is probably as old as the modern scientific enterprise and over time it has been overcome by the consideration of its proven benefits.


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THOMSON SCIENTIFIC® ISI (2007) Publication data sourced from Thomson Scientific® ISI’s Science Citation Index online by Author. Thomson scientific® ISI.


