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Strategic Knowledge Collaboration between Danish Business and Chinese Academia

*Rasmus Gjedssø Bertelsen, Du Xiangyun and Morten Karnøe Søndergaard**

Abstract: Building an innovative, knowledge-based economy is crucial for the future of China, for ensuring sustainable growth. External academic relations are central to creating this innovative economy. Sino-American academic relations through brain circulation, entrepreneurship and investments have especially received research interest. The possibilities for business from a small open Scandinavian economy to build high-level relationships with Chinese academia have not been studied. This article examines the motives of a range of Danish businesses for engaging with Chinese academia and the outcomes of such engagement. Such collaboration contributes to expected areas as innovation, science and technology, research and development, and absorptive capacity in China. However, this collaboration also builds high-level networks and reputations in China for - in this case - Denmark and Danish business. This finding is overlooked in the traditional literature on innovation in China, but it is clear when including an International Relations perspective on transnational relations.

The Importance of Transnational Research and Development and Science and Technology for Transforming the Chinese Economy

The Chinese economy has grown phenomenally since the open door policy from 1978. This growth has initially been based to a significant extent on manufacturing for export. China has enjoyed large comparative advantages in a very large supply of labor. This manufacturing for export has gradually grown into more and more sophisticated products, moving, for instance, from textiles to information and communication as well as electronic equipment (Huang, Gouveia and Varum, 2007).

It is, however, clear that the capital- and resource-intensive development model is neither socio-economically nor environmentally sustainable. China is, therefore, facing great challenges to transition to a sustainable innovative and knowledge-based economy. The capital- and resource-based manufacturing-oriented growth in Eastern China has created enormous social and demographic disparities and imbalances in China. In addition, China is

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facing increasing cheap labor competition from countries such as Vietnam and Indonesia for its old comparative advantage of cheap manufacturing labor. China is, therefore, hard-pressed to produce economic growth based on innovation and knowledge. Developing such an economy depends largely on the innovation, science and technology (S&T) as well as broader research and development (R&D) policies pursued by China (Huang, Gouveia and Varum, 2007; Cao, Suttmeier and Simon, 2009; Lundvall et al., 2009; Schaaper, 2009).

The fundamental role of innovation, S&T and R&D for economic growth is clearly acknowledged by the Chinese leadership as is evident in the recent “National Guidelines for Medium- and Long-Term Plans for Science and Technology Development (2006-2020)”. This plan commits China to “indigenous innovation” (*zizhu chuangxin*) (Cao, Suttmeier and Simon, 2009).

R&D activities in China have expanded rapidly in recent years and are planned to increase further in coming years. As examples, it can be noted that the revenue and output of the 53 national high-technology zones had grown to over 1,300 billion RMB in 2001 (Huang, Gouveia and Varum, 2007); the Chinese central government’s budgetary expenditures and appropriations for R&D grew from around 10 billion RMB in 1980 to over 40 billion RMB in 2002 (Huang, Gouveia and Varum, 2007); China’s gross expenditures on R&D/GDP ratio dropped from 1.5% in 1978 to about 0.6% in 1996 rising back to 1.3% in early 2000s in a much, much bigger economy (Huang, Gouveia and Varum, 2007); between 1991 and 2003, China’s R&D expenditure grew from around 15% to 75% of Japan’s R&D expenditure, from around 10% to around 40% of EU-25’s R&D expenditure, and from less than 10% to close to 30% of the R&D expenditure of the USA (Huang, Gouveia and Varum, 2007); the average R&D expenditure growth rate between 1995 and 2005 in China was above 20% as compared to around 5% for UK and USA (Huang, Gouveia and Varum, 2007); the Chinese share of global high-tech manufacturing grew strongly from 2.4% in 1990 to 12.3% in 2003 replacing European and Japanese manufacturing (Huang, Gouveia and Varum, 2007). The engagement of China in international scientific organizations, both inter-governmental and international non-governmental organizations, has grown very rapidly. This growing engagement is part and parcel of the Open Door policy of bringing S&T to China (Xu, 2008).

The Medium- and Long-Term plan for S&T outlines a growth in R&D expenditure from 1.42% of GDP in 2006 to 2.5% in 2020, increases the contributions to economic growth from technological advances to over 60%, decreases dependency on foreign technology to less than 30%, making China one of the top five countries in the world for invention patents,

and making Chinese-authored scientific papers among the most cited in the world (Cao, Suttmeier and Simon, 2009)

The determination of China to strengthen innovation, S&T and R&D has also been clear from the “markets for technologies” policy, where China has sought technology transfer from foreign companies in exchange for access to the Chinese market. This policy has made China the manufacturing center of the world, but also increased China’s dependence on foreign technology (Cao, Suttmeier and Simon, 2009).

Despite the leadership attention to innovation and the advances in Chinese S&T and R&D, China is still much-dependent on foreign S&T, and an innovative and knowledge-based economy is far away. China is still much more dependent on foreign technology than leading innovative economies of the world, and Chinese manufacturing pays dearly for foreign technology out of slim profit margins. China has suffered brain drain of its best talent. Chinese R&D is comparatively weak in basic research and much activity is in development. Most patents in China are held by foreign corporations. China trails a list of nations in ratio of R&D expenditure on basic science to Gross Expenditure on R&D (GERD) with 5% compared to, for instance, the USA at close to 20% in 2004. In light of these facts, China is pressed to become an “innovation-oriented society”, and its leadership is keenly aware of this (Huang, Gouveia and Varum 2007; Cao, Suttmeier and Simon, 2009).

Technology transfer through R&D partnerships, brain circulation and foreign direct investment

Transnational transfers of S&T have played an important role in strengthening innovation in China. This transfer is the other side of the coin of the dependency on foreign corporations for R&D in China and for transferring technology through foreign direct investments. The sophistication of the electronics and office machine industry—which is export-oriented—and the rapid rise of high-tech products in Chinese manufacturing are products of foreign direct investment. Brain drain has hindered development in China, but brain circulation through Chinese students and scholars abroad and investments by overseas Chinese have contributed to strengthen innovation in China (Cao, Suttmeier and Simon, 2009; Schwaag Serger, 2009; Saxenian and Sabel, 2008; Saxenian, 2006).

An important part of the transnational contributions to the development of innovation, S&T and R&D in China, are the many R&D centers established in China by foreign corporations. In 2009, Sylvia Schwaag Serger listed 51 foreign corporations with global R&D

centers in China (Schwaag Serger, 2009), but there are many, many more R&D centers adapting products to local markets and supporting manufacturing and sales. Danish business is also part of this trend, and the Innovation Center Denmark—Shanghai informs us of 20 companies as members of its Innovation Community with R&D in China as of the end of 2011; this list is not complete. Haldor Topsøe engaged Chinese academia intensively back in the early 1980s, and Novo Nordisk was a very early foreign biotechnology company to establish an R&D center in China in 1995 (the Haldor Topsøe and Novo Nordisk cases are discussed in detail below). The establishment of R&D centers by foreign corporations in China is well-described in the literature (Schwaag Serger, 2009).

However, the literature on the R&D involvement of foreign corporations in China overlooks the engagement with Chinese higher education and research institutions. This omission is serious, since such involvement is a potentially very important contributor to developing an innovative, knowledge-based economy in China. As the Danish cases in this paper show, such involvement can contribute to a number of areas of great importance for a future innovative, knowledge-based Chinese economy: this involvement often contributes more to basic or translational research than corporate R&D does. It contributes to training Chinese research students and qualifying researchers and research managers. Such training is a significant contribution to creating S&T human capital and absorptive capacity to expand Chinese S&T and adapt knowledge and human capital from abroad.

The transformation in China until the mid-1990s has been focused on technological innovation enhancement and high technology development, which raised the rapid growth of the Chinese economy. The past decades have witnessed increasing attention to the need for a shift in the economic growth with stronger emphasis on a knowledge-based economy via “endogenous innovation” and “harmonious development” (Gu and Lundvall, 2006).

In consequence, the Chinese government plays an important role in supporting industry growth by encouraging their innovation engagement via a series of policies, in particular, in the aspect of boosting the collaboration between industry, universities and other R&D institutions (China State Council, 2008). For example, Chinese companies have been strongly recommended to outsource R&D to local universities and government R&D institutions to improve their innovation process, while universities and other R&D institutions are encouraged to transfer their endogenous innovation products to industries with privileged conditions. Nevertheless, little has been addressed in these policies stressing collaboration between Chinese universities and foreign industry in particular.

The literature on foreign research ties with China has emphasized the development of an innovative, knowledge-based economy. Applying an International Relations perspective brings to light the important transnational relations created by such ties. Nye and Keohane's (1971) definition of transnational relations highlight how Sino-foreign academic ties channel ideas, information, talent and resources in both directions. This paper on the relations of Danish business with Chinese academia shows how such relations can build transnational elite networks between Danish business and Chinese government and academia while creating trust, reputation and credibility.

Chinese higher education and research institutions as transnational actors

Higher education and research institutions, including the Chinese Academy of Sciences and universities, can play central roles as transnational actors and cultural brokers between societies. They often engage to a high degree in what Nye and Keohane (1971) defined as "global interactions": moving ideas, information, talent and financial resources across borders. Universities can play a significant role for such "global interactions" connecting a range of public, private and civil society actors transnationally (Bertelsen, 2012). However, this transnational role for universities is generally overlooked in the literature on universities, which has been national or comparative and not transnational in scope (Stevens, Armstrong and Arum 2008). Stevens, Armstrong and Arum (2008) introduce the role of universities as hubs connecting sectors of society, but only touch briefly on the transnational role. Upcoming research, however, will remediate this situation (Stevens and Miller-Idriss, 2009).

Likewise, higher education and research institutions can play important roles as cultural brokers, since they can be places of cultural encounters both between national and professional cultures. Research is an exceptionally transnational activity; knowledge knows no borders and is pursued across borders (Stichweh, 1996). Academia has therefore historically been transnational and the highest levels of research particularly so. This transnationalism has been parallel to the role academic institutions have played in nation- and state-building.

Academic institutions have also been spaces of cultural encounters between professional cultures of research, industry, policy, culture, civil society, media, etc. The combination of national and professional cultural brokerage has led to particularly fruitful encounters of actors from public, private and civil society sectors across borders (Bertelsen, 2012).

This article explores the extent to which businesses of a small open economy, Denmark, are able to build connections with Chinese higher education and research institutions and through these institutions with Chinese society in a broader sense on a high level. The article explores the motivations of Danish businesses to seek collaboration with Chinese academic institutions and the outcomes of such collaboration. It seeks to explain these outcomes.

“Sea turtles” as cultural brokers: the importance of transnational academic experience

The importance of individuals in facilitating transnational academic relations, for instance, between Danish business and Chinese academia points to the importance of the “hai gui” or “sea turtles”: Chinese who have studied and/or worked in the West and returned to China. As will be clear from the cases below, “sea turtles” play a key role in facilitating transnational R&D and S&T relations between Danish business and Chinese academia.

Academics have therefore sometimes played the role of cultural brokers between national cultures, and especially leading academic institutions have gathered leading intellectuals across borders and served as spaces of cultural encounters. However, an important notion on cultural brokerage in this context is that, while academic institutions might foster the right framework, being a melting pot for different inputs, the ability to perform in terms of cultural brokerage is typically anchored with the individual; the cultural broker.

What characterizes the able cultural broker is an ability to code and decode in terms of values and use of linguistics (Søndergaard and Veirum, forthcoming; Søndergaard and Veirum, in progress). The cultural broker is frequently found among people who have strongly diversified life experiences and educational backgrounds. Basically, what seems to be the case is that having a diverse run will underline the individual’s ability to handle different types of information and reinterpret these in new settings. Furthermore, it seems that another central feature of the cultural broker is an ability to negotiate input. It is not only a matter of being able to handle diverse inputs, but also being able to recognize inputs that are perhaps more qualified on a given agenda. The essence being that the cultural broker is not threatened by stronger or more persuasive intellectual proposals, but is able to recognize these, and adjust them into a common agenda. This also reflects a third and vital point, which is the cultural broker as focused agent. In order to achieve results, diverse inputs must be handled, they need to be negotiated, and finally they need to be put into action. In order to

deliver in the latter context it is vital that the cultural broker is able to cut through and keep focus. Cutting through will, however, only be allowed if the preceding negotiations have been conducted in such a manner that all participants, still at the table, feel included and respected (Søndergaard and Veirum).

Therefore, when searching for gateways with higher education and research institutions, it is important not only to look for interesting professional research environments, but equally important to look for specific types of individuals. Though it might be tempting to suggest that these are predominantly found at the leadership level, given that leaders are routinely faced with negotiating and handling different viewpoints, this is far from the case. The able cultural broker might be found at almost any level of the organization. Cultural brokerage is predominantly an individual skill.

Access to Chinese academia for a small open economy

Great powers have the financial and academic resources to engage in academic diplomacy, and such states enjoy the prestige to attract attention and talent. Multinational corporations based in such states also enjoy the financial and research status to attract attention and form partnerships, for instance, in China at the highest level. This paper addresses the possibilities of a small state and its business to attract the academic attention of China and form partnerships at a high level reaching people of influence in various sectors of Chinese society.

Academic diplomacy (or science diplomacy) together with educational and research exchange and collaboration has formed part of the foreign policy strategy of great powers. The USA and the USSR each engaged intensively in building networks and socializing foreign decision-makers through education, exchange and collaboration during the Cold War (Richmond, 2003; Parmar and Cox, 2010). Today, the USA engages strategically in socializing future elites in the Middle East through, for instance, the “Tomorrow’s Leaders Scholarship Program” of the Middle East Partnership Initiative (see also Rugh, 2006).

China is also highly conscious of soft power and public diplomacy considerations (Li, 2009; Ding, 2008; Li, 2008; Kurlantzick, 2007; Lai, 2006; d’Hooghe, 2005). China has in recent years invested heavily in academic public diplomacy through the Confucius Institutes at universities around the world, teaching Chinese language and culture and connecting foreign universities with Chinese universities. The educational and research exchange between the USA and China today and in recent years is of strategic importance for both countries.

Methodology: structured, focused comparison; discussion of case selection; confidentiality

This study is based on a structured, focused comparison (George and Bennett, 2005) of the collaboration of Danish businesses with Chinese academia. This comparison focuses on the motivations of such collaboration and its outcomes and seeks to explain these outcomes. There are an insufficient number of cases of Danish business collaboration with Chinese academia to warrant a quantitative study. A structured, focused comparison is preferable for gaining theoretical insights from this material. Asking a set of structured, focused questions on the cases allows for drawing theoretical lessons (George and Bennett, 2005), because the comparison is “structured” by a set of general questions of motivation for and outcomes of knowledge collaboration between Danish business and Chinese academia, and because the comparison is “focused” on certain aspects of the cases, the collaboration with Chinese academic institutions.

The selection of cases is based on a discussion of the qualities of the individual cases for drawing theoretical lessons (George and Bennett, 2005). The cases are selected based on their ability to supply general theoretical lessons. It is, therefore, of central importance whether the cases are “most likely”, “least likely” or “crucial” for the theories being evaluated (George and Bennett, 2005).

The Danish businesses in this study are among the most technologically or operations-wise advanced Danish companies. As such, they are “most likely” or “crucial” cases for the ability of Danish business to build academic transnational relations at a high level in China. If these companies fail to do so, it is an important sign that a small state is significantly hampered in building such relations.

The group of cases is identified through interviews with experts on Sino-Danish business-academia R&D collaboration and with the help of the Innovation Center Denmark in Shanghai. The Center has made the membership list of its Innovation Community available. There are 20 companies on the list. These companies represent the most innovative and research-intensive Danish companies in China. The list is therefore considered to give a valid picture of the research activities of Danish business in China. The companies on the list, together with a few additional companies identified through interviews, provide a sufficient background to study the research engagement of Danish business with Chinese academia.

The collaboration of the individual businesses with Chinese academia is outlined in cases of varying length, since this collaboration is of vastly differing length, intensity and

prominence. The individual cases are based on interviews with R&D managers in China, senior R&D executives in Denmark or senior executives.

The interviews are confidential. Therefore, the motivations of the individual companies and the outcomes of their collaboration with Chinese academia are not described for the individual company cases. The motivations for this collaboration and its outcomes are discussed at the end of the paper detached from the individual company cases.

Danish Business Collaboration with Chinese Academia

Our expert interviews and the advice of the Innovation Center Denmark—Shanghai have identified ten Danish companies engaging in R&D collaboration with Chinese academia, such as the Chinese Academy of Sciences and universities. This number is probably not exhaustive, since not all companies have answered our repeated attempts to contact them. However, we believe it gives a valid picture of Danish corporate R&D collaboration with Chinese academia, which makes it possible to draw valid conclusions on the motivations and outcomes of such collaboration.

Engaging in R&D in China is seen as an important and necessary strategic move for global companies wishing to operate in China but also globally. Traditionally, the first step in establishing R&D in an emerging market is local R&D to adapt products to the local market and to draw on local knowledge in the product adaptation and development. R&D for developing products for global markets is a further step ahead (Schwaag Serger, 2009). Engaging in translational or basic research in an emerging market are steps still further ahead. We see the same pattern among Danish corporate R&D activities in China. The lowest level of engagement is local product adaptation in in-house corporate R&D centers and the highest level of engagement is basic research in conjunction with the Chinese Academy of Sciences followed by universities. In this paper, we are interested in the higher levels of R&D engagement with Chinese academia.

The Danish Ministry of Science, Technology and Innovation published in 2008 a strategy for Sino-Danish knowledge collaboration (Ministeriet for Videnskab, Teknologi og Udvikling 2008). The strategy focuses on university-to-university collaboration, but there is also mention of collaboration between Danish and Chinese academia and business. There is a proposal for facilitating and funding network collaboration between public- and private-sector Danish and Chinese researchers (instrument 9). In 2007, the Danish Ministry of Foreign Affairs and the Danish Ministry of Science, Technology and Innovation opened the

Innovation Center Denmark in Shanghai, which supports the connection of Danish and Chinese business and research institutions (instrument 10). It is possible for Chinese businesses and academia to take part in Innovation Consortia with Danish partners. The strategy proposes to facilitate trainee- and internships for Chinese students in Danish business.

However, our interviews with centrally-placed Danish officials concerning Sino-Danish innovation collaboration did not yield any mention of Danish strategy to further the engagement of Danish business with Chinese academia. Also, our interviews with R&D and innovation leaders of Danish businesses working with Chinese academia did not yield any mention of such a strategy. Therefore, it seems that to Danish officials and Danish businesses there is no official Danish strategy to promote the engagement of Danish business with Chinese academia (as there was not an official Chinese strategy to promote the engagement of foreign business with Chinese academia).

Haldor Topsøe, exceptionally early strategic research engagement with Chinese academia

Haldor Topsøe is one of the most R&D and S&T intensive Danish companies of all. It is a globally leading developer and manufacturer of catalysts for chemical processing. It stands out for its exceptionally early research engagement with China. All the way back to around 1972 or shortly thereafter, Haldor Topsøe engaged with China in connection with the construction of a catalyst-manufacturing facility in Northern Manchuria. In 1984, leading Haldor Topsøe scientists organized a seminar for the Institute for Coal Chemistry, Taiyuan, Chinese Academy of Sciences, where they laid the foundation for a strong bond with its director Bao Han Chen. These contacts lead to an agreement of collaboration with the State Commission for Science and Technology.

In 1985, Haldor Topsøe scientists visited the Dalian Institute for Chemical Physics, where the director, Li Yuan, shared his Stanford background with that of Jens Rostrup-Nielsen of Haldor Topsøe. This connection with the Dalian Institute for Chemical Physics continues to the present day. The same year, Haldor Topsøe scientists visited a gas works in Shenyang leading to an early project with the Central Coal Mining Research Institute.

In 1986, Bao Han Chen visited Haldor Topsøe in Denmark to conclude an agreement on a demonstration facility for gasoline manufacturing. This project was approved by the European Communities in May 1989. The Tiananmen Square crackdown in June 1989 led to European and Danish sanctions against China, which put a freeze on this Danish-European-

Chinese project. In September 1989, Haldor Topsøe scientists participated in a seminar at the Dalian Institute of Chemical Physics. At this occasion, Bao Han Chen emphasized their interest in continuing to work with Haldor Topsøe, despite Japanese overtures. The European sanctions were lifted in 1990, but not the Danish sanctions, and in 1992 Haldor Topsøe had to inform the European Commission that the project could not go forward for Danish political reasons.

Between 1986 and 1991, Haldor Topsøe was engaged in a research collaboration with Central Coal Mining Research Institute and the Dalian Institute of Chemical Physics. Haldor Topsøe withdrew in 1991 from this collaboration because of intellectual property rights (IPR) concerns. After this withdrawal and the freeze on the European project, Haldor Topsøe S&T relations with China were through individual scientist's connections with the Dalian Institute for Chemical Physics.

In 2004, a leading Haldor Topsøe scientist was invited as an editorial board member of the Journal of Natural Gas Chemistry and to co-organize Natural Gas Conversion Symposium at the Dalian Institute of Chemical Physics. Today, Haldor Topsøe has no R&D in China, since all R&D is placed in Denmark. However, the company is globalizing increasingly, and R&D in China is a possibility. It is building on old ties to the Dalian Institute of Chemical Physics.

Novo Nordisk collaboration with the Chinese Academy of Sciences

Novo Nordisk is a leading Danish pharmaceutical and biotechnology company, which is the world leader in insulin development and production and diabetes treatment. Until the demerger of Novo Nordisk and Novozymes in 2000, it was also a major industrial enzyme producer. In 1997, Novo Nordisk was the very first foreign pharmaceutical company to establish an R&D center in Beijing. In 2002, Novo Nordisk opened a new R&D center in Beijing that in 2004 relocated to the Zhongguancun Life Science Park. This research center is expanding markedly, doubling its staff from 100 to 200 researchers over the next 3-4 years. The commercial R&D of Novo Nordisk in China has been described by Julie Marie Kjersem and Peter Gammeltoft (2009). This paper addresses the R&D engagement of Novo Nordisk with Chinese academia, which in this case means the Chinese Academy of Sciences (CAS).

In March 2007, Novo Nordisk and CAS signed an agreement to establish the Novo Nordisk—Chinese Academy of Sciences Research Foundation with an endowment of 2 million USD. Any associate professor (or above) at the Chinese Academy of Sciences can

apply for funding for collaborative projects with Novo Nordisk scientists and possibly scientists at Danish or Swedish universities. There are also funds for symposia, PhD or postdoctoral fellowships (Novo Nordisk ndb).

In 2008, Novo Nordisk started supporting CAS Novo Nordisk Great Wall professorships at CAS with a 1 million USD donation. The program consists of ten professorships each supported by 100,000 USD over three years recruited from the “Hundred Talent Program.” The professorships are in protein sciences and technologies, including structural biology, protein-ligand interaction, biopharmaceuticals, antibodies, immunology, inflammation, and diabetes. The positions aim to stimulate cooperation in the field of science, innovation and education between scientists at Novo Nordisk, Chinese Academy of Sciences and Danish or Nordic Universities (Novo Nordisk nda).

In 2009, Novo Nordisk established the SIBS-Novo Nordisk Translational Research Centre for Pre-Diabetes together with the Shanghai Institutes of Biological Sciences of the Chinese Academy of Sciences (Anonymous 2009, Diderichsen nd). Together with the Chinese Academy of Medical Sciences, Novo Nordisk has established the Novo Nordisk Union Diabetes Research Talent Fund in 2009 with a 1 million USD donation.

Dampskibsselskabet Norden and Shanghai Maritim University: building strategic networks

DS Norden has worked with Shanghai Maritime University (SMU) since 2005. Norden awards scholarships for outstanding students at SMU and gives awards to the best professors (selected by the students). The company invites SMU professors and students to spend time at Norden’s offices. Senior managers from Norden organize workshops at SMU twice a year.

Grundfos supporting university education and standardizations work

Grundfos works with a couple of Chinese universities. It conducts tests at Harbin Institute of Technology, where it has also donated materials for teaching. This collaboration originates in Aarhus as a sister city of Harbin, which facilitates collaboration between Aarhus companies and Harbin institutions. In Beijing, Grundfos is the only foreign company working at an equal level with Chinese actors with the Chinese Standardization Bureau. In Shanghai, Grundfos supports the seminar of a Danish-educated professor, and it gets computer models validated. A Grundfos engineer is associate professor at a Shanghai university.

Lundbeck engaging with Chinese neuroscience key opinion leaders

Lundbeck is a leading pharmaceutical company concerning the central nervous system specializing in neurology and psychiatry. It has until recently had R&D centers in Denmark and New Jersey, USA. In October 2011, it opened a Research center in Shanghai. Lundbeck has collaborated with Chinese researchers for the last five to six years, and the Research center is aimed to engage further with leading Chinese neuroscience research institutions such as the Institute of Neuroscience in Shanghai and the Institute of Biophysics in Beijing of the Chinese Academy of Sciences, Peking University, Tsinghua University, Fudan University, Beijing Union Medical College and the University of Science and Technology of China. In addition, Lundbeck is seeking to form partnerships and collaborations with biotech and pharmaceutical companies in China.

CCBR clinical trials together with university teaching hospitals

Center for Clinical and Basic Research (CCBR) is headquartered in Denmark and operates 16 sites for clinical trials around the world. These sites are usually clinics, but in Beijing it is an R&D company due to certain government registration regulations in this field. This requirement means that CCBR in Beijing cannot conduct the trials independently, but must collaborate with hospitals approved by the Chinese State Food and Drug Administration (sFDA) in the good clinical practice (GCP) context. Such hospitals are usually tier 1 university teaching hospitals. CCBR works with Beijing Friendship Hospital and Nanfang Hospital for conducting clinical trials. Clinical trials in China are either motivated by a requirement for Chinese data for a submission for approval to the sFDA, or a need for Chinese bioequivalent data. Data generated from such trials in China are also part of the global data for the specific trials.

CCBR Beijing has a general research agreement with Beijing Friendship Hospital (BFH) since year 2005 jointly conducting clinical research and basic research. Under such agreement, one medical doctor from BFH every year will come to Copenhagen receive GCP training and will be engaged in basic research for 6 months at CCBR headquarters.

ALK Abello engaging medical key opinion leaders in China

ALK Abello produces allergy vaccines. It introduced its first commercial product in China in 2004. China has traditionally had limited knowledge of modern science-based allergy vaccines and been limited to traditional Chinese medicine treatments. ALK Abello seeks to work with key opinion leaders in its field. It works with respiratory doctors, pediatrics and

ear, nose and throat specialists. It runs a joint hospital-based Allergy Research Centre with a key opinion leader in Guangzhou. Activities in the Center include basic allergy research and epidemiology, training and education of medical authorities and customers, quality control and local release of ALK products for the Chinese market. In the last three years, it has published 15 papers together with key opinion leaders. ALK Abello has contributed to Danish-Chinese brain circulation through “sea turtles”. It has educated a good handful of PhD students jointly between the University of Copenhagen, the Technical University of Denmark and ALK Abello in Denmark. Two of these PhDs are employed at the ALK China Research Center and play a key role connecting the company to Chinese regulatory authorities and medical key opinion leaders.

Arla Foods

Arla Foods is a major Danish-Swedish dairy company. It has been engaged in China producing infant formula for five years in a joint venture with Mengnui. Arla Foods is keenly aware of the need for Chinese data for approval reasons and Chinese research to promote its products to Chinese healthcare workers. It is currently establishing a small virtual research institute in China with a prominent international-level committee. This institute will award research grants to Chinese researchers in hospitals and universities for both basic and clinical research through its committee.

Vestas

Vestas has a large R&D center in Singapore and has worked with Tsinghua University and Xian Jitong University in Beijing, as well as supporting PhD projects. In addition the Singapore R&D center works with utilities and grid research institutes, the China Electric Power Research Institute and the State Grid Energy Research Institute.

The missing cases: finance, law, culture and media

The overview of Danish corporate R&D in China and collaboration with Chinese academia shows a clear picture of sectors. It is the pharmaceutical, food and manufacturing sectors together with a rare example from shipping. It is interesting to look at which sectors are not represented, where the services sector is markedly absent.

The financial sector is central for creating an innovative, knowledge-based economy. Financial innovation is crucial for developing the financial sector. China’s financial sector is significantly under-developed, and developing the Chinese financial sector would deliver

significant economic gains. Developing the Chinese financial sector and furthering financial innovation in China is of the highest importance (Fan et al., 2009). This paper shows the strategic importance for Danish business—and Denmark in general—of creating transnational relations with Chinese academia. It is, therefore, highly regrettable that the Danish (and Nordic, of which it forms part) financial sector seems in no way engaged with Chinese financial scholarship and research. Danish financial sector engagement with Chinese financial academia could contribute to Chinese financial innovation and to building strategic transnational relations with a sector that is crucial for Chinese development.

Another services sector absent from China is legal services, where the same argument of strategic transnational relations could be made. The absence of Danish financial or legal services R&D engagement with Chinese academia reflects that these Danish sectors are absent from China. Foreign banking and legal practice is less represented in China, which is explained by Chinese regulation of these sectors. However, in light of the strategic value of transnational relations with top academia for elite network access as described in this paper, the lack of strategic R&D engagement in banking and law is regrettable.

Denmark is a service economy, where cultural products play a large role, also in foreign trade. The relevant science for cultural services is cultural studies, humanities, and media studies. It is therefore equally regrettable that there seems to be no strategic engagement of Danish publishing and media with Chinese academia in these fields. Danish publishers could through strategic relations with leading culture and media scholars engage with the current and future editors in the broadest sense of the Chinese cultural market.

We have also interviewed large consumer products companies, which are very R&D intensive in Denmark and have large operations in China without R&D there. It appears that since they appeal directly to the Chinese consumer independently of scientific and technological gatekeepers, they do not need to engage in strategic R&D activities in China to gain access to key opinion leaders there.

International property rights and R&D engagement with Chinese academia

There are important intellectual property rights questions associated with corporate R&D activities in China. Working in China is well-known to raise IPR challenges, which become the more acute in R&D. The less R&D is “in-house” and the more it engages with outside collaborators, the more acute the IPR issues become. Corporate R&D collaboration with local

academia, therefore, raises important and interesting IPR issues, and solutions to these issues are key to facilitate such collaboration.

Issues of IPR come up in every interview about Danish corporate R&D engagement with Chinese academia, except for the shipping line DS Norden. Protecting IPR is a major concern and constraint for every other company interviewed for this study. One company strongly suspects reverse engineering from previous collaboration and has limited collaboration with Chinese academia for this reason. Central proprietary information is kept in R&D centers in Denmark, and research collaboration with Chinese academia covers basic or pre-competitive research, that is, research which cannot be directly applied commercially. The Danish company may have a first right of refusal for patenting such research carried out with Chinese academia. Some of the most S&T-wise advanced companies outright reject producing in China for fear of leakage of knowledge.

However, there are also some signs of optimism among the informants. The protection of IPR is improving in China, and Chinese authorities are increasingly aware of the importance of IPR protection in order to promote an innovative knowledge-based economy in China. However, there are important issues with the implementation at local and court levels of IPR protection.

There is also a very sanguine attitude among the interviewed companies that the only protection of IPR is continued development. One will inevitably be copied, and it is only through continued R&D that one can stay ahead of the imitators. It is through the ability to issue warranties on one's work and products and embedding one's products in broader webs of, for instance, disease management, that one can stay ahead of imitators.

Conclusion: Strategic Engagement with Chinese Academia for Elite Networks, Trust and Reputation, but Perhaps Missed Opportunities for Cross-Cultural Learning and Innovation

This study shows that Danish business engages with Chinese academia and successfully creates strategic networks, builds reputation and trust, and demonstrates commitment to a future innovative, knowledge-based Chinese economy. Such results are dependent on the technological or operations standing of the company and the duration and depth of its engagement with Chinese academia. However, in their strategic motivation for this engagement, Danish business may overlook opportunities for learning from China, cultural

brokerage with the country and culturally-driven innovation in their R&D engagement with Chinese academia.

Creating an innovative, knowledge-based economy is crucial for China's future development and for securing sustainable economic development and growth. Transnational academic relations in the fields of public and private research collaboration and investment, student and research exchange and brain circulation are of central importance for furthering innovation and a knowledge-based economy in China. There is research attention to these transnational academic relations between China and the outside world. The academic relations between China and the USA, especially in terms of brain circulation and investment patterns, have received much academic interest (Saxenian and Sabel, 2008; Saxenian, 2006; Saxenian, 2005; Zweig, Changgui and Rosen, 2004; DeVoretz and Zweig, 2008; Wang, Zweig and Lin, 2011; Zweig and Wang, 2012). There has been research attention to corporate Danish R&D in China (Kjersem and Gammeltoft, 2009), but not to the research engagement of Danish business with Chinese academia.

The importance of Sino-Western academic relations for the future development of China and relations with China raise the question of the possibilities of business in a small state to create such relations. Can Danish business create high-level relations with Chinese academia, or is this the preserve of multinational corporations originating in great powers? This article shows the possibilities and limits for Danish companies in different sectors and of different sizes to build relations with Chinese academia. It shows the motivations of these companies and the outcomes.

It is clear from this study that Danish businesses can engage at a high level with Chinese academia. There is a tendency among these Danish businesses to feel that they contribute more than they are learning. The motivation for this engagement with Chinese academia is strategic and not academically motivated for the majority. However, there is also recognition of the vast talent pool in China and the quality of leading Chinese institutions. A small minority of the companies indicate the motivation of truly bilateral research cooperation.

This engagement is about building networks, spotting talents, and creating reputation and trust. Creating elite networks and building reputation and trust is considered particularly important in China, where connections matter to a large extent. This collaboration centers on building networks with the most central current and future Chinese individuals in the area of business of the Danish company. The companies emphasize ensuring brand recognition

among current and especially future Chinese decision-makers in their area of business. Especially the pharmaceutical companies highlight the importance of *key opinion leaders* among Chinese scholars and clinicians. It is considered key to introduce a new product on the Chinese market to get access to key opinion leaders, work with them and get their endorsement of the product. The same logic applies to other industries, but is stated differently. Consumer products companies appeal directly to the Chinese consumer without recourse to scientific and technological gatekeepers.

China strongly encourages technology transfer from foreign companies as is evident from the “markets for technologies” policy, which, however, has met limited success in creating indigenous innovation. In accordance with that, interviewed Danish companies emphasize the importance of being perceived as a company with a strong commitment to China, to be perceived almost as a local company. It is an important strategic motivation to show the ability and the will to engage with Chinese research institutions and to be present. It is important to show a commitment to contribute to capacity-building in China. This goal is perhaps the most important strategic motivation for most of the R&D engagement with high-level Chinese academia described in this study: building trust with Chinese political and scientific leaders and creating a reputation as a company committed to the development of China.

The interviewed companies express great satisfaction with reaching these strategic goals of networks, trust and reputation. Chinese scientific and political authorities acknowledge large and early investments in engagement with Chinese academia. The return on these investments is goodwill. Chinese decision-makers are said to highly value persistent, loyal, credible commitments to China expressed in—especially early—investments in production *and* R&D in China.

It seems clear from this study that it is possible for global, high-tech companies of even a small economy like Denmark to reach these strategic goals through investments in R&D engagement with high-level Chinese academia. Danish business does not operate in a power vacuum, but originates in a small state. Even large and technologically and operations-wise highly sophisticated Danish corporations cannot rely on the political and economic clout of a great power. According to the interviews for this study, market- and technology-leading companies do not experience this fact as a handicap. Such smallness can be overcome, for instance, by an early and persistent engagement and investments in China. However, knowledge-intensive Danish businesses are aware that the top talent of Chinese youth is

mainly attracted to American academia with Danish higher education much less well-known and attractive.

The importance of transnational academic linkages at the individual level is also clear from this study. The so-called “sea turtles”, Chinese who have studied and/or worked in the West and returned to China, play a key role as cultural brokers between Danish business and Chinese key opinion leaders in academia, practice and regulatory authorities. The small state status of Denmark is evident concerning “sea turtles”; only few “sea turtles” working for Danish companies have Danish educational or work experience, while many have US experience. This fact naturally limits familiarity with Danish research and business, but adds additional experience and networks in the global center of high-tech business and research, the USA.

In the strategic focus of the R&D engagement with Chinese academia, there is a lack of attention to aspects of learning, cultural brokerage and culturally-driven innovation in this cultural encounter. Danish business potentially risks losing opportunities of learning about China, cultural brokerage and innovating radically new products and services with this attitude.

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