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Hubert Schmitz / Dirk Messner (eds)

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Abbreviations

CIMC	China International Marine Containers Group
DIE	Deutsches Institut für Entwicklungspolitik
EU	European Union
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GHG	Global Greenhouse Gas
IDS	Institute for Development Studies
IPCC	Intergovernmental Panel on Climate Change
MOFA	Ministry of Foreign Affairs
NCCCC	National Coordination Committee on Climate Change
NDRC	National Reform and Development Commission
OECD	Organisation for Economic Cooperation and Development
R&D	Research and Development
SCO	Shanghai Cooperation Organisation
TRIPS	Trade-Related Intellectual Property Rights Agreement
UNFCCC	United Nations Framework Convention on Climate Change
US(A)	United States (of America)
WTO	World Trade Organization

I Global transformations and new questions

Hubert Schmitz and Dirk Messner

Introduction

This paper is concerned with one of the big issues of our time: the rise of China and India and the challenges which this presents for Europe. It concentrates on the rise of China and India as innovation powers and on their increasingly important role in finding solutions to global climate change. In both these fields, European business and policy needs to address issues of conflict/competition but also find ways of working together with China and India. And both fields are related to each other in that innovative capacity is essential for mitigating climate change. Ways forward require the ability to define the issues clearly and see them from both the Asian and European side. This is precisely what we sought to achieve at a workshop held in Bonn, 17–18 January 2008. The ambition was to go straight to the frontiers of knowledge and identify the questions which future policy oriented research needs to address.

At this workshop, we succeeded in:

– bringing together European and Asian perspectives, expressed by leading researchers, high level policy makers and influential business leaders;

– integrating the innovation and climate change agenda, generating insights and suggestions from all sides, including the business leaders;

– showing how the common divide between research and policy can be overcome and how agendas for research and action can be developed together;

– identifying key organisational challenges that need to be confronted in conducting a research programme which brings European and Asian researchers together and which can influence policy processes and outcomes.

In a publication it is impossible to recreate the richness of the debate and the excitement of the participants. Our aim here is more modest: to bring together some of the key inputs into the workshop. These inputs result from a project which was funded by the Volkswagen Foundation and carried out jointly by the German Development Institute (Bonn) and the Institute of Development Studies (Sussex).

1 What are the issues and why are they important?

The purpose of this project was to frame the field of enquiry and define the key research issues which arise for Europe from the rise of China and India and to then ‘test’ the resulting agenda with experienced researchers, policy makers and business leaders.

In order to develop the agenda, the German Development Institute (DIE) and Institute of Development Studies (IDS) research teams asked: why are European politicians and policy makers concerned about the rising powers of Asia? These reasons vary a great deal (depending on prejudices, positions and responsibilities), but they seem to boil down to three underlying concerns:

– maintaining or increasing prosperity
– ensuring that this prosperity is sustainable (in economic and environmental terms)
– finding a vision for Europe's changing political and economic role in the world.

This in essence is what it is all about. Most of the public discussion is driven by fear about prosperity: has it peaked, will it decline, would a rise be sustainable? The counter-position, exemplified by Leadbeater / Wilsdon (2007) is that there is no zero sum game, that there are enormous opportunities, that decline and conflict can be avoided.

The research team then concluded that by focusing on innovation and climate change, one can go to the heart of this debate: innovation jobs are the bedrock of West European prosperity. The key questions are: a) whether China's and India's advances undermine the European innovation-based competitive advantages, specifically in the areas of energy and resource efficiency; and b) whether and how Europe can work with China and India in order to find mutually acceptable solutions in the global governance arenas dealing directly and indirectly with climate change.

Climate change has become a driver of change in its own right. Reducing carbon emissions has risen to the top of the policy agenda in Western Europe, driven by concerns with maintaining high levels of living for current and future generations. China's and India's growth trajectory seems in direct conflict with this objective. Finding solutions requires understanding dynamics internal to these countries, understanding the reasons for the failure of global collective action, and developing viable low carbon technologies.

In both political and technological terms, Europe is well equipped to deal with these challenges. If politicians and policy makers cannot find a leadership role for Europe in innovation and climate issues they are unlikely to find it anywhere else.

This is how the research team prioritised the issues and delimited the field of debate. The papers included in this publication set this out more fully and then deepen the analysis and refine the research issues. Before introducing these papers, it is useful to map out the changing global context.

2 Three waves of global change

In order to contextualise the challenges faced by Europe, it is useful to distinguish between three waves of global change – captured in Figure 1. The main characteristic of the first wave is the massive reduction in the barriers to flows of goods, finance, and information in the 1970s, 1980s and 1990s. Trade liberalisation and rapid advances in transport and communication technology facilitated a major shift of manufacturing capability away from the countries of the Organisation for Economic Cooperation and Development (OECD) to the developing world. The speed with which these capabilities were acquired was accelerated by the integration of developing country producers into global value chains governed by lead firms in the USA or EU. Politically this economic globalisation was characterised by the declining power of nation states, which was not accompanied by more effective global governance. These global governance failures were most visible in the inability to curb the volatility of global financial flows.

While the effects of the first wave continue to be powerful, a second wave became noticeable as from the turn of the century emanating from the new powers in Asia. In order to give expression to this new reality we called them 'Asian Drivers' (Kaplinsky 2006). While the OECD countries continue to be important, the *change* comes primarily from Asia, in particular China but increasingly also India. This second wave undermines the perception of 'globalization as westernisation or even americanisation'. As discussed throughout this paper, this shift in power has begun to define the agenda of the global political economy – for both researchers and policy makers.

While we are still catching our breath, a third wave is on its way: global climate change. While seen by some as scare mongering of over-enthusiastic environmentalists, it is increasingly recognised that climate change is real and that global warming poses unprecedented economic and political challenges arising at global and local levels. European prosperity is based on globalised energy, transport and production systems which are not sustainable in their current form. The pressure for action will mount at local, national and global levels. In this sense, climate change is more than just an additional dimension to be considered by governments, enterprises and citizens. It is rapidly becoming a driver of change in its own right (WBGU 2008).

Figure 1: Three waves of global change: the great global transformation towards 2050

1st Wave: Globalisation due to lowering of barriers to flows of goods, finance, information and culture

- trade liberalisation
- rapid advances in transport and communication technology
- competing in the global economy as an imperative for all national economies
- integration of developing country firms into global value chains governed by lead firms in EU & US
- limitation of nation states
- increasing complexity and decreasing effectiveness of global governance

2nd Wave: The Asian Drivers of global change … radical power shifts

- acceleration of globalisation
- changing global distribution of production and innovation capabilities
- major shifts in relative prices of raw materials and manufactures
- new power constellation
- from a unipolar to a multipolar world order
- shift of economic power from the West to the East

3rd Wave: Climate change as a driver of global change … large scale changes in the earth system

- 3.5 – 6 degree Celsius world as a threat to the global economy
- acceleration of adaptation costs
- low carbon economy and new global energy system needed
- global development and security impacts
- international distributional conflicts emerging
- impact on many global governance arenas: energy, trade, migration
- challenging the adaptation capacity of the global governance system

3 Developing the research agenda

The previous section set the global context for our research. This section outlines our agenda for research on how the economic rise of China and India affects European prospects and policies. It does this by introducing the four papers produced by our research team and included in this publication.

Poor and powerful

The first paper by John Humphrey and Dirk Messner asks what is so special about China and India. It is easy to think of China and India as merely reinforcing existing processes of globalisation but this view would miss their key new feature: they are powerful due to their size and prolonged fast growth, but at the same time they are poor in terms of per capita income of the majority of the population. Because they are poor, their priorities, strategies and institutional capabilities are very different from those of other leading global actors. Their competitive threat is also very different because they can combine advanced technology with low wages. At the same time, these two countries differ – in particular with respect to their trade-GDP ratio and political systems – requiring different approaches from their European partners and competitors.

While these issues have been clear for some years, European policy is struggling to come to terms with the new reality, searching for new mental maps and a new role in this new and unstable multi-polar world. Policy research has an important role to play here, provided it includes an understanding of the dynamics internal to China and India. In their paper, Humphrey and Messner begin to provide a framework for such policy research, focusing on the fields of innovation and climate change. The new research agenda in these fields is then presented in the subsequent papers.

Key questions for research on innovation and the low-carbon economy

Tilman Altenburg's paper 'New global players in innovation? China's and India's technological catch up and the low carbon economy' identifies the following key questions for future research:

- Do China's and India's emerging innovation capacities compete with Europe or are they complementary? How is this relationship changing over time?
- What are the key mechanisms for technological catch up in China and India?
- Does the shift to a low carbon economy strengthen Europe's competitive advantage?
- How likely is a European-Asian consensus with regard to global regulation in the field of climate change and on the way towards a global low-carbon economy?
- What is the potential for technological cooperation between Europe and the Asian Drivers?
- How can low-carbon alliances be strengthened across the European-Asian and public-private divides?

Key questions for research on the dynamics of national and global climate change policies

Imme Scholz, in her workshop paper 'Climate change: China and India as contributors to problems and solutions', presents research questions which focus on the politics of national and global regulation in the area of climate change. Amongst the most important questions are:

– What are the political factors which determine climate change policy and implementation in China and India, and how are these changing?
– Which actors advocate a proactive policy or strategy for mitigating climate change?
– Which are the procedures for policy co-ordination? Which factors determine their effectiveness and how are they changing?
– What is the potential for an EU engagement with China and India to influence these policy making and implementation dynamics?
– How have China, India and the EU positioned themselves in international negotiations on the post-2012 regime?
– How far are they able to shape the regime according to their expectations? Which interests and power constellations does the agreed regime reflect?

How to organise the required research?

The final paper by Hubert Schmitz asks: how can the proposed agenda be researched and acted upon in an effective way? Which way of organising the research is likely to yield the best results?

The existing division of labour in scientific research is a major obstacle for understanding how the rise of China and India affects European economy, society and policy. New forms of interaction are needed within research, between research and policy, and between Asia and Europe. There is a need for:

– bringing together those working on the *internal dynamics* of China and India with those researching the *external impacts*;
– integrating different competences; integrating different disciplines and approaches;
– observing changes through European and Asian lenses;
– constructing common interests across the Europe-Asia and the public-private divide.

The paper specifies the insights which can be gained from working on intersections and bringing together different perspectives. They are essential not just for understanding the new reality but also for new creative action. The paper argues that the governance of research and funding has a major influence on the kind of insights and findings one can expect. It then contrasts different ways of managing the research, highlighting strengths and weaknesses of the different approaches.

The debate

These were the key inputs[1] for the workshop in Bonn which brought together European and Asian researchers, policy makers and business leaders. Many other valuable presentations were made, available on www.die-gdi.de/die_homepage.nsf/FSdakt?Open frameset.

The workshop debates were insightful but it is difficult to transmit the learning processes, not least because these were different for different participants. There are however some unexpected results that can be distilled from the debate:

– Policy makers at the workshop warned that analysing the advances of China and India in terms of 'catching up' leads to fundamental misunderstanding. These countries found their own way of moving forward and these need to be understood in order to understand the challenges for Europe.
– Progress in bringing together the innovation and climate change agenda during the workshop was faster than expected given that these are still separate policy and research communities. Their integration was embraced by all participants, including the business leaders.
– It was recognised that the strength of the research initiatives lies in working on the inter-connections of different problem areas. However, this was coupled with a warning against an overly integrated programme where everything connects with and depends on everything else. There was good advice to reduce complexity and find a way of modularising the research programme.
– The workshop showed how quickly perceptions are changing in China and India, in particular with regard to priorities and policy challenges related to climate change and innovation. This leads to rapid changes in concrete processes of technology and policy development. These changes are relevant for European cooperation strategies in many areas, namely science and technology, development and climate change.

The future

The most difficult stage in a research process is not to answer questions but to pose them. The biggest cognitive leap lies in identifying the most relevant questions. This is what we sought to do in the papers brought together in this publication and the workshop which they fed into. The resulting research agenda is big, certainly too big for our own research teams and our partners in China and India. The purpose of this publication is to make the results of our efforts available to others keen to work with us on one of the biggest and most exciting construction sites in the field of policy research.

1 Much of the groundwork for these inputs was carried out in three previous papers: Altenburg / Schmitz / Stamm (2008), Gu / Humphrey / Messner (2008), Richerzhagen / Scholz (2008).

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II Key issues and framework for policy research

John Humphrey and Dirk Messner

1 The Asian Drivers: changing European perceptions

European *policy* has been challenged for some time by the need for global approaches to issues such as economic management, health, global security, migration and climate change. At the same time, increasing global interconnectedness has created new threats and opportunities for the European *economy*. The reduction in barriers to trade, investment and financial flows have opened Europe to increasing competition, but also created new opportunities for European firms. Within this context, the rising Asian powers in the global economy are a new phenomenon to be taken into consideration. European policy makers are rightly focusing their attention on the implication of this phenomenon for Europe's goals of: (i) maintaining or increasing prosperity within Europe; (ii) ensuring that this prosperity is sustainable, and (iii) supporting and developing multilateralism as the basis for global governance.

The recognition of the relevance of the rising Asian economies for achieving these goals is something new. Until recently these countries were not seen as key actors in the formulation of responses to the challenges of globalisation. Europe, and the OECD countries more generally, perceived themselves as the power centres of the world economy and world politics. Even in the 1990s, discussions on the future of the world economy and of the global governance architecture turned around the concept of an OECD-led global order. The collapse of the Soviet Union intensified this perception of the Europe-US-Japan triad as the focal point of global initiatives. The mental maps and strategic frameworks of European governments were shaped by the idea of a world dominated by the West and based on the transatlantic relationship as the core of the world economy and of world politics.

This orientation can be seen in various aspects of EU policy up to and beyond the beginning of the new century. The EU security strategy of 2003 focused on the new global challenges by emphasising international law as anchor of European foreign policy and searching for complementary roles of the EU and US superpower in a western based global governance system. The European debate on the future role of the European Union in global politics and economics has remained focused on the question of whether Europe could be a ‘Partner der USA auf Augenhöhe’ (equal partner) or a ‘junior partner’ of the US. China and India were not playing any significant role in this first European security and foreign policy strategy. Similarly, a document prepared by the European Commission for the Lisbon European Summit in March 2000 – whose focus was strengthening the innovation capabilities of the European economies and enabling the European Union to grow fast in the context of globalisation – contained 23 references to the US, one to Japan, and none to China, India or Asia (European Commission 2000).[2]

2 This absence of references includes variations such as Indian, Chinese etc.

In the past few years, perceptions of the role and importance of China and India in the global economy and global politics have altered radically. It is now clear that an epochal shift in economic and political power from the West to the East is taking place. The rise of China and India as drivers of the global economy and global politics is likely to be a defining moment of world history for much of the twenty-first century. China's growing economic power is evident for all to see. Some observers argue that India might become even more successful than China (Rodrik / Subramanian 2004).

The Economist is a good barometer of the transformation in perceptions. In 1999, it observed that *"The US bestrides the globe like a colossus. It dominates business, commerce and communication; its economy is the world's most successful, its military might second to none"* (Economist 1999, 15). In 2006, it was emphasising the importance of the emerging economies: 'Emerging economies are driving global growth and having a big impact on developed countries' inflation, interest rates, wages and profits. As these newcomers become more integrated into the global economy and their incomes catch up with the rich countries, they will provide the biggest boost to the world economy since the industrial revolution' (Economist, 2006, 3). Extrapolations of current growth trends can be used to show that by 2050 China and India will be the first and third largest economies in the world (Wilson / Purushothaman 2003).

The emergence of China and India on the global stage creates many new challenges for European policy. With respect to the goal of maintaining and increasing prosperity, these new economies are simultaneously competitive threats and market opportunities, as was highlighted by Wim Kok's Lisbon Agenda group:

> *"International competition is intensifying, and Europe faces a twin challenge from Asia and the US. The potential rapid growth of the Chinese economy will create not only a new competitor to Europe, but also a vast and growing market. For Europe to take advantage of the opportunity, it needs to have an appropriate economic base, recognising that over the decades ahead competition in manufacturing goods … is going to be formidable. Indeed China, industrialising with a large and growing stock of foreign direct investment together with its own scientific base, has begun to compete not only in low but also in high value-added goods … India's challenge is no less real – notably in the service sector where it is the single biggest beneficiary of the 'offshoring' or 'outsourcing' of service sector functions with an enormous pool of educated, cheap, English-speaking workers. Asia's collective presence in the world trading system is going to become more marked."* (High Level Group 2004, 12).[3]

The 2004 European Competitiveness Report included a chapter on China, emphasising the opportunities and threats, but also arguing that the opportunities offered by China include the chance for European companies to improve their competitiveness by taking advantage of China's low costs. European firms may be able to use Chinese opportunities to maintain their competitiveness in the global economy (and hence sustain European living

3 This discussion of China and India as potential competitive threats and potential markets has the merit of clearly distinguishing the differences between these two countries. All too frequently, these differences are overlooked or downplayed in the rush to emphasise their size and rapid growth.

standards): *"as European firms have been relocating activities to China in order to profit from its cost advantage [e. g. through vertical Foreign Direct Investment (FDI) carried out by multinationals] they have been improving their overall competitiveness vis-à-vis international competitors"* (European Commission 2004a, 273).

Nevertheless, this report also emphasised that the enlargement of the EU creates heterogeneity, with the 'China challenge' facing the new member states (which compete more directly with China in global markets) being very different to the challenge facing the EU 15. While the latter face the challenge of maintaining leading knowledge-based industries, the former face a direct challenge from China in sectors such as textiles and garments and electronics assembly (European Commission 2004a, 261–3).

At the same time, the rise of China and India affects Europe's stance towards global governance and multilateralism. Their increasing economic and political weight means that they are both contributors to the problems that global governance needs to solve (for example, climate change, health and global financial stability) and essential contributors to viable solutions to these problems. As various writers have emphasised, the rise of any new powers that might challenge the position of the leading global power creates a potential for instability. Tammen / Kugler / Lemke (2000) predict from their power transition perspective:

> *"From today's vantage point, there are only two (great power transitions … on the horizon. The first is China, overtaking the United States, and the second … is India overtaking either China or the United States. If China and India develop as satisfied great powers, then these transitions will occur under peaceful conditions. If they develop with significant grievances against the international system, then these transitions could result in war."* (Tammen / Kugler / Lemke 2000, 42).

The importance of these rising powers for the resolution of pressing global problems is seen particularly clearly in the area of climate change, which is now one of the most critical issues for the sustainability of European prosperity, as will be discussed further below.

The overall challenge for Europe is summarised in Figure 1. The general trends of globalisation with respect to increasing global interconnectedness and competition, and the challenges that these pose for global governance have been evident since the 1980s. However, their characteristics, and the challenges posed for the European economy and European policy-making have changed decisively as a result of the emergence of new powers in Asia. Equally, however, this new global configuration poses challenges for the Asian Drivers themselves as they negotiate their way into unfamiliar territory in global economics and politics and have to navigate their way between the conflicting pressures coming from the United States and Europe.

Figure 1: Implications of the Asian Drivers for European policy		
	World economy	**Global governance**
Globalisation in the 1980s and 1990s	Increasing interconnectedness and competition	New challenges for global governance – whilst under US hegemony
Asian Drivers in 2000s	New competitors in the global economy, new global divisions of labour, new bases for competition	Increasing complexity of global governance, new competitors in global governance arenas, and the emergence of multi-polarity

The remainder of this paper will outline the implications of this developing relationship for both the Asian Drivers and for Europe. It will highlight key research questions, focusing on the pressing issues of competitiveness and building a coalition to meet the challenge of reducing greenhouse gas emissions. The paper argues that China and India possess specific characteristics that make them decidedly different global economic and political actors from OECD countries, and that this specificity needs to be understood and taken into account. It then outlines the key issues around innovation, climate change and the interaction between the two that are the subjects of discussion at the workshop. Finally, the paper suggests a way of taking forward this intellectual agenda.

2 The new challenge from China and India

Global interconnectedness has long posed challenges for the European economy, particularly with respect to industrial restructuring. Large parts of Europe have had to reinvent themselves in the face of increasing global competition, from both advanced countries (notably, Japan) and from low-income countries that have become the new workshops of the world for labour-intensive products. This process has been going on since the 1960s (see, for example, Fröbel / Heinrichs / Kreye 1980) and became particularly acute and visible in the stagflationary period of the 1970s. The European Union policy itself has encouraged this competition and the restructuring it created through devices such as the Outward Processing Trade (OPT) mechanism and its waves of expansion to the South (the Iberian Peninsula and Greece) and later to Eastern Europe. The strategy adopted by the higher-income countries has been to adopt the knowledge-economy model, emphasising the need to promote innovation and knowledge-based industries in order to sustain competitiveness.[4]

The fact that new countries are taking their place in the global economy is not itself the novelty of the current period. Fifty years ago Japan was developing rapidly. Thirty years ago South Korea began to emerge as a rapidly growing East Asian economy that posed new challenges, and new opportunities, for Western firms. The consequences of their rapid growth for Europe and North America were substantial – not only for the European industries that found it difficult to compete (automobiles, televisions), but also for the European industries that responded to this new competitive threat by offshoring and

4 For a discussion of European innovation policy, see Huang / Soete (2007).

outsourcing. The new international division of labour was, in large part, a response to these new competitors.[5] New global competitors do emerge from time to time.

Similarly, the increasing interconnectedness and interdependence created by globalisation processes has been putting strain on the institutions of global governance for a long time. Interconnectedness increases the possibility of contagion – in areas as diverse as severe acute respiratory syndrome (SARS) and financial markets. New challenges arise which can no longer be managed within the confines of nations, or even regions. Again, such trends have been visible for a long time and were discussed globally after the publication of the Global Governance Report, prepared by the Commission on Global Governance in 1995. But until very recently western actors have been seen as the major drivers of global governance processes. Now, China and India seem to significantly change the rules of the game in global policy making.

3 What is so special about China and India?

In this context, it is easy to think of the rise of China and India as reinforcing existing processes of globalisation. But China and India do not merely represent 'more of the same', but rather they are a significant new phenomenon for four reasons. First, they are both increasingly powerful/influential and competitive, although they choose to exercise this influence and also compete in the global economy in different ways. China and India's size means that their economic impact is, and will be, that much bigger than was the case for South Korea or Singapore. This is particularly the case for China, which displays the unusual combination of considerable size and a high ratio of trade to gross domestic product (GDP). This size aspect also has consequences for other countries. For example, in discourses on global warming it is the total quantity of actual and projected greenhouse gas emissions from India and China that demand attention. Similarly, China's large size means that its exports and imports have a clear impact on global prices.[6]

Second, these two big countries are still poor. Because they are poor, their priorities, strategies and institutional capabilities are very different to those of other leading global actors, and their competitive threat is also different. With respect to economic and political priorities, sustaining rapid growth is a high priority for both China and India. This has direct implications for the shape of any future commitments to emissions reductions, and also the domestic political sustainability of the implementation of any such deal in these countries.[7] And although the resource use and greenhouse gas emissions of both China and India as still poor countries are much lower than those of the OECD countries, they are both inevitably involved in developing global solutions to global problems because their great size means that in absolute terms they are a significant part of the climate

5 In this respect, it is worth noting that the pioneer of outsourcing in the American electronics industry, Fairchild, took the decision to relocate assembly of semiconductors to Hong Kong as early as 1961, and in response to the growing threat to the US semiconductor industry from Japanese manufacturers (Grunwald / Flamm 1985). This is an early example of how an established economic power can use relocation to Asia to maintain competitiveness in the face of new challengers.

6 The impact of China's demand for resources on global commodity prices is well-known. Equally, China's exports have noticeable impacts on global prices for manufactured goods (Kaplinsky 2006).

7 One of the lessons of the Kyoto Agreement is that implementation of commitments made on climate change is also a political and economic challenge for all signatories.

change equation. The complexity arising from poverty combined with size and influence has been noted by Leadbeater / Wilsdon (2007) in their analysis of Asian innovation. They choose the term 'hall of mirrors' to denote how China and India (and South Korea) looked very different when viewed from different perspectives.

With respect to the competitiveness challenge to Europe coming from these two countries, their low incomes create a challenge not only for the manufacturing industries of Central and Eastern Europe, but increasingly to the knowledge-based industries of Western Europe. What makes this challenge specific is that China and India, while still poor, are acquiring the science and technology skills to compete with Europe in innovation-intensive industries, and given the large scale of their investments in human resources and state support for industrial upgrading, they will be competitive threats.

Third, both countries are non-western societies, with distinct cultural and political backgrounds, and precisely because they are non-western countries, it is more difficult for western scholars to understand the academic and political discourses taking place in these countries. At the same time, the encounter of these countries with the West in global fora is likely to change the perspectives and positions of both sides quite quickly, lending a dynamic element to the interaction. We see with China, for example, that debates on international relations, global governance, political philosophy and business management concepts are not structured along the well established paths of western theory building in these fields (see Gu / Humphrey / Messner 2007). Therefore, the scope for misunderstanding (between academics, but even more important, political decision makers) is huge.

Fourth, the simultaneous rise of China and India confronts Europe with two emerging Asian global players, who compete with each other regarding the supremacy in Asia (and with other Asian regional powers) and who are developing very different patterns of regional cooperation (in economic and political terms). This makes their advance different from the rise of the US at the beginning of the twentieth century or of Japan in the 1960s and 1970s. The rise of China and India could furthermore – beyond the respective impact of each of these countries on global dynamics – imply a general shift towards Asia (Dollar 2007).

To sum up, China and India are a new type of global competitor. They are becoming economic powerhouses, and they increasingly have capacity to mobilise and provide leadership for other developing countries through organisations such as the G20 and G77.[8] As they develop the capacity to define agendas for global governance and to give voice to their concerns and the concerns of other developing countries, they translate their economic power into political influence in multiple arenas of global governance.

8 Recognising that this increased leadership role does not by any means suggest that China and India will not face difficulties and challenges in their relationships with other developing countries. This is already evident in some parts of Africa, as well as in the strained relationships that both countries have with their near neighbours.

4 The challenge for Europe

We are going through a very special period of global change. Given their size and their dynamic development, China and India are the only actors worldwide that have the potential to challenge western dominance in global affairs or even US hegemony. Once the Asian Drivers establish their global role, the probability of further power transitions at the global level diminish dramatically. This creates radically new challenges for Europe. The challenges involve not only the formulation of new strategies for the emerging new world order, but also developing the capacity to make informed choices. More specifically:

1. Outcomes are not determined. In the current period of transition from the unipolar domination of the United States towards a multipolar (potentially bipolar China-United States) world, Europe has the capacity to make a difference in outcomes through the way that it contributes to the overall management of the transition, and the resolution of particular global governance challenges.
2. In devising its policies in this field, Europe has to recognise that it competes with these countries both economically and politically, but also needs to collaborate with them in the pursuit of mutual goals. It now has to develop a similar complex relationship with China and India, but one in which the partner countries have different priorities to those of the established powers.

Finding a fruitful basis for collaboration that enhances rather than undermines European welfare and competitiveness and drawing these countries into collaboration over the production of global public goods are major challenges. At the same time it is crucial to understand that the competitiveness-collaboration dynamic is different to that for Europe in relation to the United States and Japan given the specific characteristics of China and India spelled out above. At the same time, Europe has a strong interest in drawing these countries into collaboration over the production of global public goods, but once again, the challenges are different to those seen in relation to the OECD countries.

5 How significant is the rise of Asia, and in what ways?

It is worth emphasising that different and conflicting views still remain about the significance of the Asian Drivers. At present, at least three different perceptions on the consequences of the rise of China and India for Europe (and the OECD countries in general) can be distinguished:

1. Zürn (2007) emphasises the continuing poverty and weakness of China and India, arguing that there is no real power shift and that in terms of both global governance and innovation and competitiveness, the future impact of China and India is wildly overestimated. The defining relationship will remain that between Europe and the United States. This view is also shared by writers such as Hutton (2007), who emphasise the weakness of China's development and the great potential for an economic crisis.
2. Mearsheimer (2004), in contrast, emphasises the size and potential future impact of these economies, and sees their simultaneous rise as representing a fundamental power shift towards Asia. Mearsheimer (2001), in common with many ‘neo-realist’ international relations specialists (Susbielle 2006), argues that the rise of China, in

particular, will lead to conflicts, fierce competition, fragmentation of the world economy and a global inability to respond to issues such as climate change. Global governance will be paralysed by the 'tragedy of great power politics' (Mearsheimer 2001) and by the difficulties of transition from current US global hegemony to a multipolar world.

3. In contrast to these two positions, Kupchan (Kupchan / Adler / Coicaud 2001) accepts that the rise of new global powers does create problems and challenges for those nations whose dominance is threatened, but he argues that increasing interdependence between nations raises the possibility of joint solutions, although the cultural gap between the Asian powers and Europe and the United States creates particular problems. This underlines the need for greater understanding and exchange of views between the rising and established powers. Strategies to create preconditions for a peaceful power transition and to help the emerging and the established powers to perceive each other as benign are urgently needed.

The uniqueness of the emergence of the 'poor but powerful' new global powers lies precisely in the peculiarity of the situation as culturally and economically different, but increasingly important for Europe. Understanding not only the positioning of these powers within the global economy and global politics, but also the rapidly changing mosaic of domestic and external factors that influence this positioning is essential if Europe is to engage with these new powers in a constructive manner. Given the characteristics of these countries as both relatively poor and late comers to the global economy, the tools and experience of development studies and development research are particularly pertinent to this task.

6 Global governance, climate change and innovation

Within the broad range of issues around which Europe needs to engage with and understand better China and India (and also to formulate more clearly its own policies and strategic interests), we have chosen to focus on two specific topics for this workshop: innovation and climate change. This is done for four reasons:

1. These two areas are a high priority for Europe: innovation, because it is the key to continuing competitiveness and because global governance capabilities are based on the innovation capacities of nations; and climate change, because Europe has understood the severity of this problem and needs to play an active role in securing global progress on this issue.
2. They are areas where the fact that China and India are still poor has particular consequences for Europe, as will be explained below.
3. These areas bring into relief the complexities of the competition-cooperation challenge.
4. There are important areas where these two issues interact with each other.

Figure 2 summarises the relationship between these two themes, trends in the global governance architecture and the rise of the Asian Drivers. Cells 1–3 of the figure identify the ways in which globalisation processes in general impact upon the global governance architecture, climate change and innovation. These form the general context within which

the proposed research programme is located. In the second row of the figure, Cells 4–6 identify the specific ways in which the Asian Drivers bring new issues into these three areas. These are the areas of major interest for our research programme. The new challenges for global governance (Cell 4) are also part of the overall context within which the EU and the Asian Drivers will develop their relationships in the coming years. Cell 5 focuses on the issues for climate change arising specifically from the increasing salience of the Asian Drivers, while Cell 6 identifies the challenges to Europe from the rising innovation potential of China and India and its implications for European competitiveness, particularly in knowledge-based industries. The bottom line of the figure (Cells 7 and 8) identifies two key interfaces — between climate change and shifts in the global governance architecture, and between climate change and innovation – as specific foci for future research.

Figure 2: Linkages from globalisation and Asian drivers to global governance, innovation and climate change

Drivers	**Global governance**	**Climate change**	**Innovation**
Globalisation	1. New challenges to governance arising from increasing interconnectedness on multiple levels.	2. Globalisation has begun to incorporate and see rapid growth in major population centres, exacerbating and complicating the climate change issue.	3. New international division of labour and rise of manufacturing in developing countries.
Asian Drivers	4. New actors in global governance. Issues of power shifts and interests.	5. Climate change initiatives have to involve the new powers and recognise their needs and motivations (economic and political).	6. Rising innovation potential for China and India challenges European competetiveness in knowledge-intensive activities, but also creates new opportunities.
Interfaces	7. Post-Kyoto; impacts on various global governance arenas (like energy and trade policies); high time pressure; new lines of conflict and interest constellations in global politics.	8. Transition towards a global low carbon economy needed; global climate policies as an incentive scheme for innovation processes; adaptation strategies for developing countries are key (China and India included); new long wave of innovation possible.	

7 Innovation

Innovation has a central place in European debates on competitiveness. Although many factors contribute to competitiveness (such as the regulatory environment, energy policy, etc.), Europe's capacity to be inventive is an important part of this process:

> *"In a remarkably short period of time, economic globalisation has changed the world economic order, bringing new opportunities and new challenges. In this new economic order, Europe cannot compete unless it becomes more inventive, reacts better to consumer needs and preferences and innovates more."* (Commission of the European Communities 2006, 1).

As Huang / Soete (2007) point out, however, this view of innovation is curiously inward-looking – it focuses on Europe's capabilities rather than analysing the global competitiveness challenges Europe faces and how Europe will collaborate and compete with other global economic powers. If there is a challenge from competitor countries in the world, then the response has to be to improve the efficiency and productivity of the European economies and to invest more in innovation and more in translating innovation into the competitiveness of industry.

Such challenges certainly exist, particularly from China. For low-value manufacturing products, the threat is beyond doubt. Within a broader Asian context, the competitive challenge is even more severe. For many products, China is the endpoint of a production system spanning many countries in Asia.[9] The key issue, however, is the implications of competition from China and India in the production of higher-value products. To what extent will increasing export of technology-intensive products threaten European competitiveness and livelihoods?

Without doubt, there are some Chinese firms that are direct competitive threats to European companies. The high-profile ones are companies such as Lenovo and Huawei. Less obvious, but equally interesting, is the case of China International Marine Containers Group (CIMC), described by Zeng and Williamson. This company now has 55 per cent global market share for shipping containers, and far from focusing on low-end products, it also competes in segments such as refrigerated containers, containers with electronic tracking, folding containers, etc., and according to Zeng and Williamson: *"In 2005 it bought up 77 patents from a bankrupt competitor Graaff – ironically the German firm from which CMIC licensed its first refrigeration technology back in 1995. One year earlier it acquired a 60 percent shareholding in Clive-Smith Cowley, the British company that invented the proprietary 'Domino' technology that allows empty containers to be 'folded' for ease of back-hauling"* (Zeng / Williamson 2007, 3).

Such competitive threats are enhanced by the Chinese government's promotion of the upgrading of Chinese firms through policies such as protecting the domestic market, actively promoting selected industries (notably the electronics industry) through tax incentives and making technology transfer to Chinese companies a condition for foreign investment in some sectors (European Commission 2004b, 258). In addition to this, the

9 See, for example, the analyses of Ng / Yeats (2003) and Ando (2005). See also Humphrey / Schmitz (2007).

problem of weak protection for intellectual property rights in China is well-known. Not surprisingly, the EU has raised the intellectual property rights issue and the question of China's World Trade Organization (WTO) commitments in response to these policies (European Commission 2004b, 8).

Equally important, however, are the investments by foreign enterprises in both manufacturing capacity and, increasingly innovation, in China. As the 2004 European Competitiveness Report notes, European companies invest in China, exporting capital equipment and importing manufactured products. Increasingly, they are also locating innovation activities in China, as are transnational companies from other parts of the world. The reason for doing this is, in part, to be close to manufacturing facilities, to be close to what is a fast growing market, and, possibly, to take advantage of lower wage costs. The report suggests that *"European engineering industries can be attractive partners active in the industrialisation of China."* (European Commission 2004a, 268).

So, as is suggested in Cell 6 of Figure 2, China and India are valuable sources of cost-competitive products and valuable markets for EU exports, but equally actual and potential future competitors, with European firms contributing to this increasing competitiveness. Furthermore, China and India can be seen as both potentially valuable markets for European innovations, but also simultaneously as a medium to long-term threat to the technological advantage of European companies, both through the increasing capacities of Asian competitors/partners, and also because of the issues of weak protection for intellectual property rights.

So, for Europe, the goal has to be to explore the opportunities of the Chinese and Indian markets, and to sustain the competitiveness of knowledge-intensive industries in Europe, including by outsourcing some knowledge activities that can be better done in Asia, in the same way that the lifespans of more traditional industries in developed countries were extended through outsourcing of low-value activities. Similarly, the challenge for European companies is to find ways to engage in strategic partnerships with firms in China and India (maximising the benefits of collaboration), while minimising the real risk of creating strong competitors that absorb and learn from European technology and possess substantial cost advantages in innovation. Experience so far suggests that this is a very difficult challenge.

Clearly, an element of European policy with respect to innovation will be the 'adequate protection of intellectual property rights such as patents, copyrights and trademarks' (European Commission 2004b, 8), as well as access to the Chinese and Indian markets and the compliance these countries' industrial promotion policies with WTO rules. In other words, global governance questions to be pursued in fora such as the WTO and World Intellectual Property Organization (WIPO) will be issues for concern. However, in this context, the issues of competitive strategies and capabilities at the enterprise level, both of European firms and firms in China and India (and, of course, joint ventures) are probably more important. Therefore, the key issues to be addressed in this work package concern:

A. The extent to which Chinese and Indian firms are acquiring innovation capabilities and the opportunities and threats that this offers to European firms – as suppliers of technology, as strategic partners and as competitors in final markets.

B. The key mechanisms for technological catch up in China and India and how they see competition and complementarity with Europe and European firms.

C. The strategies of leading innovating European firms with respect to their operations in China and India.

8 Climate change

There are two main packages of work on climate change. The first is concerned with the issues highlighted in Cell 5 of Figure 2. The 'needs and motivations' referred to have two distinct aspects. The first relates to emissions, growth and poverty. A better understanding of these differences between the specific challenges for Europe and for China and India in negotiating and implementing any future deals on climate change (as well as devising and implementing the many other possible climate change initiatives that will complement any global deal) will be essential if Europe is to engage effectively with these new powers. The specificity of their situation has ramifications in many fields, ranging from the scramble for reliable energy sources (which has brought China into the spotlight because of its search for oil in Africa, but which is increasingly an important element of Indian foreign policy, including engagement with African countries) to a reluctance to make binding commitments on greenhouse gas emissions reductions.

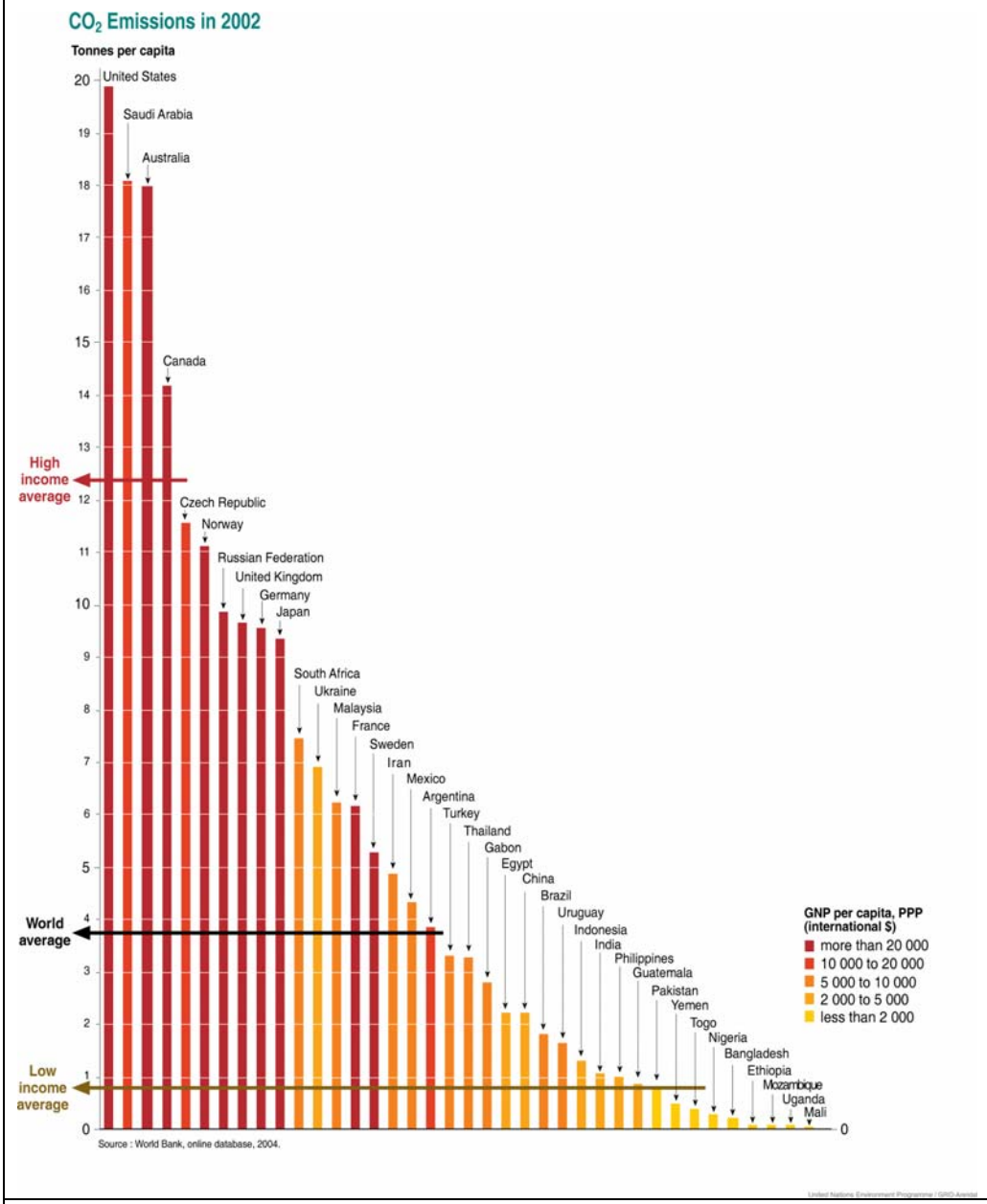
China and India are now important global greenhouse gas (GHG) emitters. There will be no feasible deal on climate change without their participation. Without their inclusion, a deal would not be politically sustainable in Europe either. For China and India, however, the increasing acceptance that climate change will have serious impact on their own societies as well as their economies and that a global response has to involve them, has to be balanced against the overriding need to sustain rapid rates of economic growth for both poverty reduction and social and political stability. Therefore, sustaining growth, but in a more carbon-efficient manner, is the challenge facing these countries. Both countries face a very difficult task in switching from carbon-intensive manufacturing and power generation to low carbon alternatives. This point is discussed further later in this paper.

The second aspect of the 'needs and motivations' concerns the way in which the political actors in both countries are able to manage the difficulties that climate change commitments will create. Even if elites accept in principle the need for action – and there are signs that they do – there are two major, and linked, challenges: (i) translating principles into practical, implementable policies, and (ii) politically sustaining the momentum for change. The first of these means translating abstract commitments into tangible and implementable policies and policy instruments. This has been and is still a challenge for some European countries, but Europe both needs to understand the constraints that policy makers face in both China and India, the differences between the two countries,[10] and the potential for European support for change.

10 On this issue, the differences in political systems between the two really matters. Indian elites face political competition. The Chinese elite does not face open political competition, but it does have difficulty in imposing its political will on lower layers of government, and climate change initiatives will have to be implemented at multiple levels.

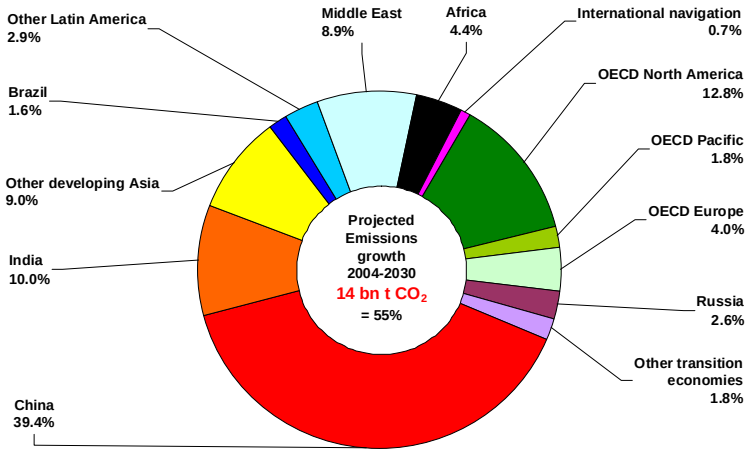
The second package of work is derived from Cell 7 of Figure 2: the interface between global governance and climate change. At the heart of the issue is the potential for climate change to act as a driver of new distributional conflicts between the motors of climate change and those developing countries that will mainly be affected by its consequences, as a driver of new North-South-tensions, and as a driver of new types of international security risks (WBGU 2007). The potential for such conflict is amply demonstrated by the 'hall of mirrors' element of greenhouse gas emissions. Figure 3 shows that China and India are still firmly among the low GHG emitters *per capita*, but it is equally well-known that they will be major contributors to increases in emissions over the next quarter century, as shown in Figure 4, highlighting the complexity of the 'poor but powerful' conundrum.

Figure 3: CO_2 Emissions, 2002



Source: World Bank, online database, 2004

Figure 4: Projected emissions growth, 2004-30



Source: IEA (2005): World Energy Outlook Papers (map produced by WBGU)

Nevertheless, it is also true that China and India have much to lose from global solutions not being found for global problems. First, poor people in poor countries are disproportionately affected by both the impact of climate change and the costs of adapting to it. Second, these two countries do wish to be seen as good global citizens, particularly with respect to their leadership and responsibilities in relation to other developing countries.[11] There are already signs that China is willing to concede that it has responsibilities for responding to the climate change challenge that are different to those of the least developed countries. From a European and Asian Drivers perspective, climate change could be perceived as a joint external threat, creating incentives for both sides to make reconciliation and cooperation an attractive option.

The United Nations Framework Convention on Climate Change (UNFCCC) conference in Bali in December 2007 provided a clear indication of the complexity of global governance processes around climate change. The EU supported developing country demands for more resources for climate change adaptation, marking a clear divergence of opinion with the United States. At the same time, the Association of Small Island States and many African States raised concerns about the consequences of failing to agree a climate change roadmap, which in many respects are different to those of China and India. This constellation asks for new patterns of cooperation between Europe and the Asian Drivers in the field of climate related policies.

The key questions for the work packages on climate change are:

A. What is the potential for an EU engagement with China and India to influence these policy-making and implementation dynamics? What are the major differences between

11 In this respect, it is noteworthy that China, in spite of promptings from both the European Union and the United States, has not broken with the G20 on the course of the Doha Round negotiations, even though it might be considered to have 'objective interests' closer to those of the industrialised countries. Similarly, China's self-presentation to African countries is based on the notion that it is a country that has more in common with Africa than the developed nations.

China and India on climate change issues, and how will this affect climate change negotiations and relations with Europe?

B. What are the institutional, economic and political factors which determine climate change policy and implementation in China and India, and how are these changing?

C. To what extent does our four-fold characterisation of the specificity of the Asian Drivers identify the key factors and dynamics in the climate policy arena?

D. How do we map the debates on diverging macro scenarios for global governance and Asian Drivers on to climate change issues? Is the climate policy arena a favourable one to avoid conflictive dynamics between the EU and the Asian Drivers, to build common interests, and to create pillars for strategic partnership?

E. What are the critical areas for European policy around global governance and climate change over the next five years?

9 Innovation and climate change

Cell 8 of Figure 2 identified the interaction between climate change and innovation as a central element of any future research programme. This arises directly from the position of the Asian Drivers as countries whose economic and political priority is to sustain growth and poverty reduction. It follows that the only way to square the circle between containing levels of increases in greenhouse gas emissions and sustaining growth is to move these economies (and the European ones) radically towards low carbon economies. Furthermore the Intergovernmental Panel on Climate Change (IPCC) Reports published in 2007 made clear that a reduction of GHG by 50 per cent globally is needed until 2050 in order to avoid a dangerous global climate change. This means that radical innovations towards a global low carbon economy are an indispensable element of any global climate policy.

This has implications for the post-Kyoto climate change regime, which will have to deal with issues like technology transfer and a global carbon trading system, as an incentive mechanism for global innovation processes towards a low carbon economy. Therefore, it makes sense to bring together global governance, climate change and innovation experts from Europe, China and India in one research programme.

But, as innovation specialists and analysts of enterprise-level adoption and adaptation of new technologies and innovation have long known, the process of diffusing technologies and promoting their incorporation into a wide range of products is a complex one. Low-carbon growth for China and India will involve innovation and the implementation of the results of innovation in products used in a range of different sectors, including power generation, construction, transport and chemicals. It will also involve improving energy efficiency across a range of different industries. Researchers that have experience of enterprise-level, cluster and global value chain adaptation of new technologies in countries that are late comers to the global economy have particular skills which are relevant to this issue.

It will become clear that global incentive schemes towards a low carbon economy within the post Kyoto regime, national innovation policies in China and India triggering into the same direction and European initiatives towards the Asian Drivers in this area will be needed in order to find solutions to the climate change challenges. The interaction between

climate, global governance and innovation specialists will be helpful to understand better the interactions between climate change and innovation processes, to integrate innovation policies effectively unto global climate policies and to consider climate change challenges as major objectives within national and international innovation strategies.

European firms have a role to play in this process, as they are, and can be, leaders in many climate related economic sectors. Furthermore they are also confronted with the challenge to transform their fossil based economies into low carbon economies. But, the innovation issues around intellectual property rights and future competition from China and India also arise. These countries are capable of catching up, possibly surpassing, Europe in some low carbon oriented innovation fields. Again the questions of the speed of the Asian Drivers learning processes, the impacts of those on Europe and the scope for strategic cooperation emerge. This poses particular problems for Europe. On the one hand, Europe has an interest in promoting the diffusion of technology, particularly in the area of climate change, both for the results in terms of carbon emissions, and also because of the market opportunities that it presents the European firms.

Our research programme will focus on four central questions:

A. Are China and India catching up in sectors and innovation fields that are key from a low carbon economy perspective?

B. Would a shift to a low carbon economy strengthen Europe's competitive advantage?

C. Which kind of impacts will these processes have on Europe (new markets, new competitors, new partners in the field of global climate change)? Which kind of strategic partnership between Europe and the Asian Drivers should emerge in these arenas?

D. What is the potential for technology cooperation around low carbon growth between Europe and the Asian Drivers, and how might low carbon alliances be strengthened across the European-Asian and public-private divides?

10 Moving forwards

A meeting held recently in Brussels between China, Africa and the EU explicitly called for more research and interaction between scholars in order to *"improve mutual understanding, identify a first set of possible ways to cooperate in a trilateral setting based on an African agenda and propose a constructive agenda between the EU and China on the one hand and take up African priorities in common on the other hand."* (Wissenbach 2007, 1). The meeting concluded that there was a:

> *"Strong shared feeling that there is a great need for better knowledge on China in Africa and of Africa in China. Actions to be considered: disseminate information/studies, promote exchanges between researchers … any initiative in the field of research should involve at least two or three African research centres from countries of different levels of development, plus Chinese and European research ones."* (Wissenbach 2007, 8).

The same could be said of the need for further research and further interaction between scholars in China, India and EU on the issues of climate change and innovation.

These issues are not ones that can simply be decided in discussions between elites about long-term strategy or immediate policy priorities. Decisions in both of these areas are likely to have consequences – distributional, fiscal, sectoral, etc. Difficult adjustments will have to be made. Therefore, the development of a broad understanding on these issues between Europe, China and India (including, very importantly dialogue between the latter two, as they are in many ways very distinct) will require an increased understanding of different constellations of interest in each society, the differential impact of particular policy initiatives across the three areas, and a sophisticated understanding of the political as well as economic sustainability of initiatives.

Therefore, this means developing research networks bringing together European and Asian Driver researchers, and in particular bringing into this network expertise in understanding the specific challenges that arise from the position of China and India as 'poor but powerful'. These countries are quite different from both the OECD countries with respect to their needs and strategies, and also increasingly different from other low- and middle-income countries in the global economy. It is also clear that the development of policies around innovation, climate change and global governance by China and India will have consequences for other developing countries, and competence in the analysis of this relationship is also one that researchers equipped with the tools of development studies can offer. Suggestions for how such a network might be structured are made in the final paper of this publication.

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III New global players in innovation? China's and India's technological catch-up and the low carbon economy

Tilman Altenburg

1 Introduction

The Asian Drivers – China and India – are of particular importance for Europe with regard to two issues:

First, they are rapidly upgrading their science, technology and innovation capacities. In some fields they are likely to catch up soon with Europe. This gives rise to both opportunities and threats for Europe. On the one hand, it means bigger export markets and lower prices in home markets. More knowledge-based patterns of development in China and India are likely to sustain their economic growth for a longer period and expand markets for European products. Furthermore, European import prices for more sophisticated goods and services may decrease, benefiting consumers as well as European firms that source from the Asian Drivers. Furthermore scientific networks will gain from enhanced research capabilities, especially taking the size of both countries' research communities into account. On the other hand, some European industries and professions will be threatened, because not only low- and medium-skill activities will face the new competition, but increasingly also knowledge-intensive activities, e. g. in mechanical engineering, software development and pharmaceuticals.

The challenge affects European nations differently. The threats are more immediate for many of the new EU member states whose factor endowments are similar to those of the Asian Drivers and who are embarking on similar strategies, e. g. attracting FDI in automotive assembly and IT services, or producing labour intensive consumer goods. But also the more innovative Western European countries need to respond to the challenges posed by the Asian Drivers, e. g. by stepping up their innovation efforts to constantly renew their competitive advantages, and by taking advantage of new opportunities to organise global value chains. In a nutshell, how fast and in which areas China and India catch up matters for all European countries. There is a need to get a better understanding of what happens 'inside' the Asian Drivers with regard to science, technology and innovation, and to rethink the Lisbon Agenda from this perspective.

Second, the Asian Drivers have become important energy consumers and polluters, and therefore obligatory partners in the search for solutions for climate change. Although per capita energy consumption and GHG emissions are still low by European standards, China and India together account for 72 per cent of the anticipated increase in global coal consumption between 2004 and 2030,[12] and will become leading greenhouse gas (GHG) emitters. In order to halt global warming it is therefore imperative to involve both countries in the search for global collaborative coping strategies. Such strategies necessarily need to build on action on two fronts:

12 Energy Information Administration (2007).

a) negotiations on climate change burden-sharing and the creation of global institutions for managing GHG reductions; and

b) the collaborative pursuit of technological innovations.

Both are strongly interdependent, as global institutions are setting incentives for research and innovation, while technological achievements allow for more ambitious political targets.

The pursuit of technological solutions for climate change is closely related to the catch-up process. Both Europe and the Asian Drivers need to abandon long established technological paradigms and shift towards a low carbon economy, with far reaching implications across all sector and fields of technology development. The speed at which countries manage to reform their economic incentive regimes and develop low carbon technologies will shape their future competitive advantages. Both Europe and the Asian Drivers are embarking on the necessary reforms, but along different trajectories, given the existing differences in per capita incomes, social values, innovation capabilities, political pressure, etc. Europe's industry is more advanced in this respect and may exploit a first-mover advantage vis-à-vis the Asian Drivers. But new technological paradigms also open up opportunities for leapfrogging that may benefit newcomers. The fact that both China and India are currently growing at roughly 10 per cent per annum allows them to modernise facilities at a fast pace and to reap enormous scale economies. Hence the competitiveness of European nations and the Asian Drivers will in all probability be affected, but we do not yet know how.

The challenge for Europe is to advance global climate governance and technological innovations for climate change without sacrificing its competitiveness. DIE and IDS will therefore organise their future 'Asian Drivers' research agenda around the following issues: The Asian Drivers as:

1. emerging competitors and partners in technology and innovation, with special emphasis on the 'low carbon transition'; and

2. emerging competitors and partners in dealing with climate change.

The present paper[13] explores the first of these issues, i.e. whether and at what velocity China and India are likely to emerge as new global players in technology and innovation; how they respond to the need for a paradigm change towards the low carbon economy; and what this *twin challenge* – the emerging low carbon paradigm shift and the increasing innovativeness of Chinese and Indian industries – means for Europe in terms of market expansion and competition. Furthermore it discusses why it is so difficult to assess the twin challenge, pointing to the peculiarities of China and India as large, poor and non-Western countries, and justifying the need for a collaborative research agenda to explore these peculiarities. The paper concludes by addressing challenges for European policymakers and identifying key researchable questions for the future work of DIE and IDS on the Asian Drivers as 'new global players in innovation'.

13 A complementary conference paper, presented by Imme Scholz, deals with the second issue: climate change governance.

2 Will China and India emerge as new global players in technology and innovation?

Within just two decades, China has emerged as a new hub in the world economy and will soon be the leading exporter. With a sustained rate of economic growth of about 10 per cent per annum for almost two decades, an increasing trade/GDP ratio and continuous attractiveness for FDI, China's role in the global economy is constantly increasing. India's economic boom is more recent (with more than 8 per cent annually since 2003), and the number of globally competitive industries is still quite limited. However its performance in the software industry is outstanding and some other industries (e. g. pharmaceuticals, automotive, steel) are also developing dynamically. Both countries have made some progress in shifting from standardised manufacturing and outsourced low-cost activities to building knowledge-based competitive advantages (Altenburg / Schmitz / Stamm 2008). The questions raised are thus: Will the two countries be able to further reduce, or even close, the technological gap separating them from more technologically advanced European countries? Will the future division of labour be based on complementarities that benefit all trading partners, or will Europe's competitive advantages and levels of welfare erode?

The catch up process, although starting from a very low level, is unprecedented. This is particularly true for China, which increased its share of high-technology exports in total exports from 7.9 to 29.9 per cent between 1996 and 2005 (OECD 2007, 14). China is now spending 1.3 per cent of its GDP on research and development (R&D), having doubled this percentage in less than 10 years. In absolute terms, China is already one of the biggest spenders on R&D worldwide and spending increases much faster than in the EU.[14] The number of researchers is at the same level as that of the EU25 and second only to that of the United States (Huang / Soete 2007, 9). In 2004 there were around half a million postgraduates in science, medicine and engineering, with a strong upward tendency (Wilsdon / Keeley 2007, 4). In addition, multinational corporations increasingly shift knowledge-based operations to China and have established about 750 R&D centres within a few years (UNCTAD 2005). Likewise, the number of Chinese firms among the top 500 companies of the world is increasing rapidly, reaching 24 in 2007 (Fortune Global 500 2007). Huawei Technologies, Lenovo, the Haier Group and many others are rapidly going global, purchasing established Western companies and establishing their own global brand, thereby challenging established companies in the EU (European Commission 2004, 272).[15]

India is much less advanced and has a less aggressive science, technology and innovation (STI) strategy (Krishnan 2007) – e. g. R&D spending has stagnated at around 0.8 per cent since the 1990s – but has nevertheless upgraded remarkably within the last two decades. The strongest factor here is investment in human capital. Each year 350,000 engineering graduates are released to the labour market (Bound 2007, 9). India also benefits strongly from return migration of highly qualified Indians from the US. Furthermore, large private

14 30 billion US$ if current exchange rates are used, or 115 billion US$ if calculated on the basis of purchasing power parities, in 2005. Depending on the calculations, China is the sixth or the second largest R&D spender worldwide. R&D spending increased at 19 % per annum since 1995 (OECD 2007, 23).

15 See also Boston Consulting Group (2006).

corporations such as the Tata Group, ArcelorMittal, Infosys and Suzlon Energy have recently enhanced their roles as global players and leaders in innovation. These companies often accessed their cutting edge technologies through international exposure and acquisitions of European and American firms. Six Indian companies have already made it to the global top 500 (Fortune Global 500 2007).

Despite their rapid progress, the level of technological development, both in China and in India, is still low compared to most European nations, in particular the old industrialised Western European countries. With very few exceptions, neither China nor India are yet challenging European cutting edge innovations. The number of patents granted by the US and EU to Chinese and Indian firms is still insignificant (Altenburg / Schmitz / Stamm 2008). In the case of China, foreign invested corporations account for more than half of its export (2005), and research-intensive high value added products are still largely imported (ibid.). Hence it is unclear to what extent knowledge-based production and innovation from Chinese territory really reflect the performance of its own innovation system.

However, there are some reasons to assume that China and India are better equipped than any other developing country to master the transition from low-value production and services to knowledge-based competitive advantages. It is the combination of market size, economic growth, strong FDI inflows (particularly China), strong bargaining power of governments, enormous capital accumulation, heavy investment in human resources and strong presence in global professional networks (entrepreneurial and academic) that make both countries' catch-up unique.[16] The mismatch between still low levels of technological development on the one hand, and enormous velocity of the catch-up process on the other explains why analyst opinions on the future technological development of both nations diverge strongly. In our opinion, it is likely that both countries will manage to build clusters of excellence in some fields of science, technology and innovation, both in the private and public domain, and that the number of multinational corporations from both countries with innovative capacity and brand reputation will increase significantly.

What does this mean for the competitiveness of Europe? In the last decades, Europe has fallen behind in the global economy, with markedly lower rates of economic growth than North America and in particular emerging Asian economies. China has successfully expanded in traditional industries and virtually crowded out European competitors. India is doing the same in software and IT-enabled services but the implications for Europe remain unclear.

These advances in Asia are not a major problem for those European countries that are able to shift to higher value added activities. Quite the contrary, these countries will benefit from new market opportunities and lower consumer prices. Furthermore, their companies will continue to reorganise sourcing strategies in a way that they benefit from low cost inputs from Asia, keeping the high-value activities at home. While there will be adjustment pains at the micro level, inter- and intra-industry trade would increase to the benefit of all trading partners.

It is a problem, however, for those new EU Member States that have similar patterns of specialisation (European Commission 2004, 253 ff.). Hungary for example has a similar

16 See Altenburg / Schmitz / Stamm (2008) for a more detailed argument.

trade structure and benefits, like China, from FDI in the manufacture of IT equipment. Several new Member States are attracting the same type of software and IT enabled services that are being supplied by India. Both the new Member States and the Asian Drivers increasingly shift towards human-capital intensive industries, thus moving in the same direction. Due to this shift, even the leading European nations in science, technology and innovation may be negatively affected if they fail to maintain or extend their technological lead. For Europe it is thus important to pay close attention to the catch-up process in China and India, define strategies accordingly and invest heavily in its own technological advancement.

3 Shifting to a low carbon economy

Low carbon technological innovations are needed at an unprecedented speed and depth if the target of keeping global warming below the critical level of two degrees Celsius above pre-industrial levels is to be achieved. According to Intergovernmental Panel on Climate Change projections, GHG emissions need to be reduced quickly: *"The key climate change models suggest that limiting warming to 2 degrees Celsius will require stopping CO_2 emissions growth in the next decade, and beginning a rapid descent in CO_2 emissions from current levels by 2050 – all while the projected energy needs of the planet grow by two to three fold over this same time period."* (Milford 2006, 3)

The research challenge is thus formidable: new kinds of renewable and cleaner fossil technologies need to be developed; new energy saving technologies are needed across almost all economic sectors, including the search for more efficient combustion engines, new materials, the use of genomics, nano and biotechnologies; new 'intelligent' logistics systems which will cut down on transport costs; better traceability and recycling systems which will reduce waste of materials. Information and communication technologies (ICT) will also play a key role. The development of low carbon technologies is thus a cross-cutting issue that needs to be built into any science, technology and innovation strategy.

Developing these innovations is complicated by the existence of a double market failure (Goulder 2004). *First,* there are the usual market failures in developing any innovation, e. g. the returns on investment incurred in R&D cannot be fully appropriated by the investor; the introduction of new technologies may require simultaneous investments (e. g. improved seeds, processing, and end-use technologies in biofuel) that require *ex ante* coordination, and pricing systems may be unable to provide the right signals to the investor; and there may be dynamic scale economies, i.e. investments have forward linkages that open up completely new production possibilities in the future. These market failures are especially likely to occur where new technological paradigms come up. *Second*, the main price for the development of low carbon technologies does not yet exist because the environmental and social costs of carbon emissions can almost fully be externalised. Hence the main incentive to develop low carbon technologies must be agreed politically and markets need to be 'governed', either through the establishment of tradable emissions rights, or minimum standards, or subsidies, or voluntary agreements.

Tradable emission rights can be most effective as a signalling device for private investors if they are globally accepted. This calls for international consensus-building and global regimes that regulate this issue. Likewise, individual governments that use subsidies and taxes to support low carbon solutions or suppress polluting technologies can easily fail if

other governments do not apply similar measures. Unilateral energy taxes for example decrease the competitiveness of downstream industries. Subsidies may even be perverted, for example if subsidies for biofuel induce producers to increase production using highly energy-consuming methods. As a consequence, new international regimes are required to incorporate climate change concerns in the incentive structure of economies (see paper by Scholz in this publication).

The double market failure and the need for international regimes make the low carbon transition especially challenging. Little is known about how to master this transition. Although an increasing body of literature deals with *innovation systems* from an interdisciplinary perspective, this literature still largely neglects the specificity of low carbon technologies, particularly the challenges of the double market failure, and the impact of global agreements on incentives. Research on innovation systems traditionally focused on *national* systems (e. g. Lundvall 1992) emphasising that the nation states determine the most important systemic variables. This is increasingly questioned by our own research on China and India (Altenburg / Schmitz / Stamm 2008) and become even more doubtful regarding low carbon innovations. Here, key incentives and regulations are determined at global or transnational levels, e. g. emissions trading, the Clean Development Mechanism, the Global Environmental Facility etc. The perspective of multi-level governance should therefore also be applied to innovation systems research.

On the other hand, the innovation systems literature does provide useful categories to analyse the transition towards a low carbon economy. This transition requires simultaneous changes on different fronts. It is not just a matter of inventing and diffusing new technologies, but also changing mindsets and habits, building alliances for change, and creating new institutions. The innovation system literature has analysed previous technological paradigm shifts and developed valuable explanations. For example, it emphasises the social and cultural embeddedness of technologies and explores the co-evolution of technology, institutions, norms and values (e. g. Nelson 1994). It explains why innovations occur along certain ‘trajectories’. In many cases, initially several competing options exist – e. g. fossil, nuclear and renewable energy technologies. Once initial decisions for or against certain options are taken, subsequent investments are predetermined. The notions of ‘technological trajectories’ and ‘path dependence’ are useful to explain why societies remain locked into certain technological paradigms. Unruh / Carrillo-Hermosilla (2006) have applied this concept to the climate change discussion in order to elucidate the multiple technological and institutional barriers that explain the current ‘carbon lock-in’. Innovation systems research also reveals that choices of technology are not politically ‘neutral’. Regarding the transition towards a low carbon economy, for example, economic and political battles take place within Europe and within China and India between stakeholders interested in new trajectories and others who benefit from the status quo. Integrating the research on innovation systems and climate change is therefore one of the most promising perspectives of our research agenda.

4 How does the low carbon imperative affect Europe’s competitive position vis-à-vis the Asian Drivers? Some hypotheses

While there is an obvious need to speed up low carbon innovations for climate change reasons, the search process also has implications for the competitiveness of nations and

therefore requires a careful balancing of national and global public interests. The low carbon paradigm influences Europe's competitive position vis-à-vis the Asian Drivers as well as the latter's prospects for catching up in a number of ways. Both Europe and the Asian Drivers have multiple, but different, incentives to develop low carbon technologies. These will result in different technological trajectories.

The *European Union* is currently the major driving force in favour of climate change action, although performance in this regard varies greatly from country to country. In some European countries, constituencies are well aware of the hazards related to climate change and put pressure on their governments and private corporations – probably more so than in any other regions of the world. Sweden, Germany, Iceland, Hungary, the United Kingdom and Switzerland rank particularly high on Germanwatch's Climate Change Performance Index (Germanwatch 2007). European industries are global leaders in many climate-related technologies, such as renewable energy technologies and low-emission power plants. Hence they are likely to benefit from an early mover advantage. As Porter (1990) emphasises, challenging home markets – in terms of demanding consumers and strict regulatory standards – are an important determinant of competitive advantage. This is likely to further strengthen European countries as low carbon technology providers – not necessarily in comparison with other OECD countries, but definitely compared to the Asian Drivers. Also, environmental industries often require collaborative solutions, and the existence of networks of complementary industries and service providers is therefore likely to favour Europe where certain well established technology clusters exist (e. g. for wind power plants in Denmark). The ability to provide integrated system solutions across different technology fields is particularly important for low carbon technologies. It should be noted, though, that some (mostly South and East) European countries are very poor climate change performers. In most cases, these are also countries with lower technological capabilities. These countries are unlikely to become drivers – and beneficiaries in terms of competitiveness – of the low carbon technology shift.

Both *Asian Drivers* on the other hand are highly dependent on imported fossil fuels. Shortages of fossil fuel supply are seen as one of the main risks for future economic growth. Both countries – and particularly China – are therefore very actively pursuing integrated strategies to secure access to international energy resources, but also to develop renewable energies and to adopt more stringent climate change regulations at home. Besides the energy security issue, China and India are among the nations that will be most negatively affected by climate change (WBGU 2008). Both countries have therefore set ambitious targets, in particular for energy efficiency and the development and diffusion of renewable energy that are likely to lead to GHG emission reduction. To what extent these targets can be achieved depends on the capabilities of both countries' environmental administrations. Lack of implementation capacity and lack of an efficient and independent judiciary may hamper the innovation drive. Finally, the lack of free markets, and a financial sector where banks are pushed to lend according to political criteria (European Commission 2004, 237), may hold back creative search processes particularly in China.

On the positive side, paradigm changes always create opportunities for leapfrogging. Previous success stories of technological latecomer development often occurred when demand conditions changed. India's software boom for example took off in the mid-1980s when the so-called Unix-workstation-standard made programming of software independent from the hardware platform. This was the start of large-scale relocation of

programming contracts (Dossani 2005). Likewise, coincidental opportunities may emerge in the development of low carbon technologies. Additionally both Asian Drivers are experiencing phases of extraordinary growth, and most projections see this trend persisting (e. g. Deutsche Bank Research 2005). Strong investment growth implies a rapid build-up of new facilities and thus accelerates technology diffusion, compared to Europe, where old facilities are not yet written off. Also, growing economies may more easily incorporate environmental reforms because all stakeholders may be better off if growth dividends are available, and veto players can be compensated (Jäger 2006, 7 f.). And finally, both countries are experienced in organising mission-oriented research, e. g. in the space and nuclear technology (see e. g. Baskaran 2005 for India). Although such politically supported missions may result in misallocation of funds, they may also help to raise a critical mass of investments in specific low carbon technologies and help to overcome coordination failures of the market.

In summary, Europe and the Asian Drivers undertake – and will probably be forced to speed up – explicit measures to promote low carbon technology development. Different demand conditions, different innovative capabilities, and different political interests and governance structures however are likely to result in dissimilar speeds and patterns of low carbon technology development. It is difficult to anticipate who will gain and who will lose (in competitiveness terms) from the shift to low carbon technologies.

5 How do the Asian Drivers deal with their 'twin challenge'? The need for collaborative research

How China and India simultaneously manage their catch-up process *and* the transition towards a low carbon economy is of utmost importance for Europe. It is important to achieve global climate targets, and it affects existing and future competitive advantages of Europe and the emerging Asian economies. Understanding this twin challenge and anticipating even the broad directions of technological change, however, is not easy and requires substantial in-depth research. *First*, because it is difficult to predict how rapidly climate will actually change, and with what effects; how rapidly the public – voters, media, consumers – will react and put pressure on policymakers and private companies to take serious actions; and what technological paradigms will emerge. Technological developments are path-dependent, and unpredictable breakthroughs in specific technologies – fusion power?; solar power?; fuel cells? – will trigger specific follow-up innovations.

Second, there is considerable risk that European researchers misinterpret developments in China and India if they do not have a thorough understanding of the peculiarities of these countries. Three peculiarities stand out (see Humphrey's and Messner's paper in this publication):

1. China and India are **non-Western countries** with different institutional structures and different values. This makes it more difficult for outsiders to understand internal processes and predict the effectiveness of Chinese and Indian institutions. With regard to industrial and innovation policy in particular, China and India strongly deviate from Western standard policy prescriptions – and nevertheless have achieved very high economic growth and a steeper technological learning curve than almost any other developing country. Their growth trajectories not only reflect incorporation of

additional workers and capital but also substantial total factor productivity (TFP) growth. It is puzzling that China and India are among the fastest growing economies of the world while both countries rank very low on the Index of Economic Freedom and the Ease of Doing Business Indicator (Altenburg / von Drachenfels 2007). China in particular supports 'national champions'; develops national standards as trade barriers; uses public procurement for industrial policy goals; offers foreign investors greater tax benefits, import/export rights, and access to the domestic market when they introduce new technologies or build up R&D facilities; largely tolerates product piracy; establishes upper limits for foreign equity shares that protect domestic companies from takeovers by international corporations, etc. The European Commission (2004, 239) warns that 'the lack of a workable competitive system combined with a heavy-handed industrial policy and widespread corruption bode ill for the creation of industrial structures that are to guide China's economic prospects in the coming decades.' Although India's government does not interfere at the same level, it also regulates many industries and implements mission-oriented policies in a centrally planned, top-down manner. It is not easy to establish to what extent these 'anti-Western' policies have been instrumental for success – or whether growth and technological catch up would have been even faster without them - the counterfactual is not available. In any case, the Asian Drivers apply non-Western sets of policies, and their economies thrive.

2. China and India are **poor countries**, with per capita incomes of 820 US$ (India) and 2010 US$ (China), compared to 36,620 US$ in Germany.[17] This has a bearing on their policy priorities and their ability to finance and implement policies. Poverty reduction and political stability rank high on the agenda of China's and India's governments, whereas climate change as such is not among the main concerns of political constituencies. Governments therefore have good reasons to focus on the development of environmental technologies that bring about immediate economic benefits (such as increased energy efficiency), and they may be more tolerant with regard to environmental spillovers with long-term effects. In some cases, the design of low carbon policies reflects concerns about poverty. India's biofuel policy for example establishes that only non-edible crops be processed and no arable land be dedicated to biodiesel production. Low incomes also imply that it is politically not feasible to impose high environmental taxes on fossil fuels or to subsidise biofuels strongly. Likewise, poor countries have less scope for financing innovations, and they have a stronger inclination towards applied rather than basic research. Related to poverty and underdevelopment is the fact that the tissue of private sector firms is less diversified and competitive. Only few companies perform systematic R&D, and few are ready to integrate in global value chains. As a consequence, FDI accounted for 58 per cent of all Chinese exports in 2005 (Freeman 2007, 18), and even though these exports are increasingly knowledge-intensive it can be assumed that most knowledge-intensive inputs come from abroad or from other multinational corporation (MNC) affiliates in China. In sum, technological priorities and trajectories are quite different from those in Europe and other old industrialised countries.

3. Both are **large and heterogeneous countries**. One of the most obvious effects is that *"on any measure, absolute numbers and per capita figures tell two different stories"* (OECD 2007, 21). In both countries, research capabilities are strongly concentrated in

17 World Development Indicators database, World Bank, 14 Sept. 2007.

distinct cities or regions, and involve relatively small populations. Great numbers of aspirants from the rest of the country seek to gain access to the modern and well-paid jobs, thereby guaranteeing an influx of 'hungry' talented people that keeps skilled wage levels low by international standards. Furthermore, market size translates into bargaining power vis-à-vis foreign investors. Especially China trades market access for technology. And finally, market size combined with high growth allows both countries to accumulate capital to finance large-scale programmes that are far beyond the reach of other developing countries.

These peculiarities imply that China and India will embark on very different technological trajectories and underline the need for in-depth *collaborative* research. In a recent paper on lessons learned from managing R&D projects in foreign firms in China, the authors – all R&D practitioners – argue that *"to realize China's potential and opportunities, it is crucial to be a part of it, grow with it, give back to receive, and most importantly be there when it happens. China is changing rapidly. What is supposed to be a 'Chinese standard' is actually a 'moving target'"* (von Zedtwitz et al. 2007, 26).

6 Challenges for European policy

The twin challenge creates new demands on European technology and innovation policy. The following five policy challenges seem to be key. Our collaborative and policy-oriented research programme aims to further specify the policy challenges:

1. Europe needs to step up its effort in science, technology and innovation in order to maintain its competitive edge and avoid price competition in similar technologies. In particular, the EU must make a stronger effort to achieve the 'Barcelona target' of 3 per cent spending on R&D. This holds for the more advanced innovators as much as for those new Member States that have similar trade structures.
2. European research policy should focus more strongly on sustainability and climate change issues. Research funding, university curricula and R&D incentives for the private sector should stimulate low carbon issues. As Milford (2006, 4 f.) observes, policy circles are currently focusing on incentives for reducing energy demand; deploying traditional renewable energies; and imposing carbon caps in the OECD. The missing element, he argues, is a massive climate technology innovation programme.
3. Europe needs to develop a coherent strategy towards China and India (as well as other emerging powers, e. g. Brazil). As newcomers, both countries have until recently been heavily underestimated by European policymakers. Strategy building in the first place requires *more thorough knowledge* about the Asian Drivers, e. g. their markets, the capabilities of their enterprises, and their policies. Currently there is a strong deficit with regard to evidence-based policy analysis. Second, it requires *consensus building among EU Member States*. Interests towards China and India diverge quite strongly. Some countries have a defensive position (e. g. reflected in disputes over textile and footwear imports) whereas others have strong interests to gain from liberalised trade and mainly press for better market access, lifting restrictions on FDI and better enforcement of intellectual property rights. Even among the most innovative European countries, approaches towards climate, energy and industrial policy diverge significantly, e. g. on the issue of nuclear energy (e. g. France vs. Germany) and state involvement in industrial policy (e. g. France vs. Britain). Third, *priorities and*

strategic actions need to be defined. Europe, and each of its Member States, need to identify where gains from cooperation can be expected, both with regard to public goods and in pursuit of national goals, such as better access to China's and India's growing markets and talent pools. This process is fraught with trade-offs. How can Europe for example share environmental technologies for the sake of climate protection, and how can it tap into the growing talent pools, without risking a leakage of its core competences? What are the trade-offs between development assistance and competition? Clear guidelines need to be developed to deal with these trade-offs in a coherent way.

4. Collaboration with China and India should be enhanced in many fields, and using multiple instruments. Our focus here is on collaborative research. As Huang and Soete rightly point out, Europe's Lisbon Agenda is too inward-looking. The authors argue against European research 'cocooning' (Huang / Soete 2007, 12) and state that *"what is today probably least needed, yet most funded, is intra-European, or more broadly 'North-North' shared research; by contrast what is most needed … is North-South shared research and knowledge diffusion."* (ibid., 29). For the reason pointed out earlier, the peculiarities of China and India as non-Western developing countries with huge global impacts and sizeable talent pools are especially rewarding for the internationalisation of research networking. In recent years, increasing attention is being given to China and India as objects of research, but not by systematically incorporating Asian researchers. It is probably not sufficient to provide a few more scholarships for Chinese and Indian students and researchers to visit European research institutions, and vice versa. What is needed are a) competences on the part of European researchers to understand technological trajectories and decision-making processes of poor non-Western countries; and b) European-Asian scientific communities that jointly develop and implement (in particular policy-oriented) research programmes. Research funds need to be redirected and role models (good practices) created on how to make such scientific communities work.
5. Policy dialogue should be enhanced with regard to issues related to climate change and technological innovation. This policy dialogue should not only be normative but also research-based. Issues for dialogue include mechanisms for burden sharing with regard to public goods as well as topics related to economic governance and collaboration. Europe and the Asian Drivers need to search for win-win constellations in economic and technological collaboration. This requires open dialogue on critical subjects that currently hamper closer relationships, particularly problems of free and fair reciprocal market access, protection of intellectual property rights and technology transfer.

7 Key questions for future research

This final section extracts research questions that will shape future DIE/IDS studies on the issue of China's and India's technological catch-up, particularly low carbon, strategies, and their implications for Europe. Our research builds on both institutions' tradition of doing comparative research on industrial and innovation policy in developing countries, and draws on well-established research and policy networks within Europe and with Chinese and Indian partners. It links up with ongoing policy research, dialogue and training activities and aims to complement them with a collaborative post-doc programme. Seven broad research areas have been identified that are a) not yet well researched and b) particularly relevant for European policy.

1. **Competition or complementarity between innovation in Asia and Europe?** In which fields will China and/or India master the transition from low value-added manufacturing and/or services to knowledge-driven economies that seriously challenge Europe's competitive edge? And if so, how rapidly? What division of labour will emerge between the EU and China, or EU and India? To what extent are technological achievements a mere reflection of increased offshoring of production sites by foreign firms, and to what degree does technological learning take place in foreign dominated value chains? Will China and India be able to endogenise the knowledge involved in such operations? How innovative are the foreign R&D centres? Will the strategic innovation activities remain in Europe?
2. **What are the key mechanisms for technological catch-up in China and India?** Are there common patterns in the evolution of innovation capabilities? Do we witness new 'models' of technological catch-up that are based on incremental upgrading of assembly activities, plus return migration of emigrants with a long entrepreneurial and academic exposure in the West, plus the acquisition of technology-owning companies, plus negotiated technology transfer – rather than synergic bottom-up developments of national clusters, as common wisdom in innovation science suggests? How important are technology acquisitions of high tech companies by Asian Driver firms? What role does R&D outsourcing play? How big is the risk of leakage of core competencies, and do cost advantages outweigh these risks? What is the role of return migration of change agents with knowledge about markets and networks? And how important are 'traditional innovation system factors', such as university linkages and local collective action? How important is market size? Does sheer size enable the Asian Drivers to exploit economies of scale and to negotiate better technology transfer conditions than other countries?
3. **Does the shift to a low carbon economy strengthen Europe's competitive advantage?** What direct and indirect incentives do Chinese and Indian governments set to develop and diffuse low carbon technologies? Are there ambitious targets/realistic expectations for major technological advancements in this regard? To what extent do these incentives contribute to the development of new competitive advantages? How does the expected shift towards 'low carbon innovation policies' affect Europe's competitive position vis-à-vis the Asian Drivers? Does Europe benefit from early mover advantages and more demanding markets, or does the paradigm change benefit the newcomers?
4. **How effective are China's and India's industrial and innovation policies compared to European practice?** Accelerating low carbon technology innovations requires government interventions, e. g. for the development of a carbon market, compulsory blending of fuels, taxing energy consumption etc. How compatible is this with existing governance styles in China and India, as compared to Europe? What are the advantages and disadvantages of more market-based vs more government-led systems in dealing with the dual market failure of low carbon technology development? China and India are countries where markets are seriously distorted by political bureaucrats in the pursuit of industrialisation and technological development goals. Does the strategic industrial policy that is pursued mainly by China (picking winners, trading market access for technologies, technological targeting etc.) accelerate or hamper technological catch-up and the low carbon transition?

5. **How likely is a Europe-Asian consensus with regard to global regulations?** How do China's and India's position evolve with regard to global regulations that affect their competitiveness strategies, in particular in the negotiation of global trade and investment regimes and regarding intellectual property rights? What global regulations exist, or are being discussed, that create incentives for low carbon technology innovations, and what is China's and India's position in this respect? Does China's proposal for a global technology fund for renewable energies provide a viable option?
6. **What is the potential for technology cooperation between Europe and the Asian drivers?** Where do complementarities exist, particularly in low carbon technologies? Where do European and Asian technology institutions have specific strengths? How can exchange programmes be intensified, and which research topics should have priority? Which innovative forms of collaborative research are most promising? How can Europe find an appropriate balance between technology diffusion in the pursuit of global public goods and the protection of European intellectual property rights? As research becomes more and more internationalised, how can Europe benefit from increased R&D spending elsewhere, and how big is the risk that the benefits of European R&D investments will be appropriated by other countries? What is the role of private sector R&D in Europe-Asian technology collaboration?
7. **How can low carbon alliances be strengthened across the European-Asian and the public-private divides?** How can collaboration among 'low carbon reformers' be fostered? Who are the most innovative partners in China, India and Europe, and how can collaborative research strengthen their role? What are the most appropriate incentives to encourage European corporations, especially those already performing R&D in China or India, to engage even more in collaborative programmes for low carbon technologies?

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IV Climate Change: China and India as contributors to problems and solutions

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1 Introduction

The main objective of our research on climate change within the context of the evolving relationship between the European Union (EU), China and India is threefold. First, we want to understand the relevance of the Asian Drivers for the further development of the international climate regime, and second, we want to elaborate categories which help to determine more precisely both the challenges and the opportunities implied by this relevance for the EU as a pioneer in this global governance arena. Third, in connection with the research package on innovation capacity, we want to explore the opportunities for learning which exist for several actors and their networks on both sides – in the EU, in China and India, between these two policy fields (climate change and innovation) and between these two regions, Europe and Asia.

The following paper presents some thoughts about what a work programme dealing with these three issues could look like. It is intended to be a starting point for further debate.

In the emerging global climate regime, the relevance of the Asian Drivers as large and growing emitters (see next section for data) was never neglected as much as it was in other fields of global collective action. In fact, their emissions were constantly used by the US as an argument for blocking progress in negotiations, by linking the acceptance of own commitments to reduction targets to the request that China and India should commit themselves as well (Davenport 2006). But despite their objective relevance, industrialised countries have not been able to develop constructive ways for involving China and India in mitigation policies and measures on a basis that could be considered as sustainable and fair.

The EU could play an innovative role in this regard, as it has already played a critical role in acting as the fulcrum of global climate change negotiations (Vogler / Stephan 2007). This has been clear in the process of ratification of the Kyoto Protocol, where the EU turned from an opponent of its flexible mechanisms to an active strategist for securing its ratification. And it was demonstrated again in the climate negotiations in Bali where the EU has played a pivotal role in bringing about the final declaration, and thus in ensuring a roadmap for the further development of the climate regime after 2012.

This strong role of the EU in international climate policy has been facilitated on the one hand by the absence of the US in this policy field, but on the other hand also by the progress made with regard to instruments and policy coordination and coherence, which showed that the EU was able to move beyond rhetoric. The European Emission Trading System is an innovative instrument for reducing greenhouse gas emissions and an important building stone of the emerging international carbon market. The EU's climate and energy policy fixed Europe's emission reduction target at 20 per cent until 2020 (compared with 1990) and linked it with further objectives in the areas of energy efficiency and renewable energy sources. These aims are not as ambitious as they could

be, but they are a first important step towards linking economic growth, energy policy, technological innovation and greenhouse gas emissions on regional and national level (Dröge 2007). At the same time, they gave an important impetus to global negotiations.

In Bali, industrialised countries committed to *"measurable, reportable and verifiable nationally appropriate mitigation commitments or actions, including quantified emission limitation and reduction objectives"*, while developing countries committed to *"nationally appropriated mitigation actions … in a measurable, reportable and verifiable manner"* (Bali Action Plan, articles 1 (b) (i) and (ii); for a political analysis of these commitments see Müller 2008). During negotiations, the Europeans backed the developing countries in the final session against the US demand for binding commitments to emission reductions by developing countries. Negotiations were difficult because industrialised countries could not reach a clear quantitative agreement on the emissions reductions they should achieve in the next commitment period. But they agreed to give more support for technology transfer to developing countries, in order to help them in controlling their GHG emissions.

In the next two years, all efforts will be concentrating on achieving an accord at the end of 2009, in order to be able to sign a new protocol in 2012 which will secure the framework conditions for global emissions trading and establish a basis for a more comprehensive integration of developing countries. In these two years, dialogue and cooperation with China and India will be crucial for overcoming the obstacles on the way to 2009 and beyond – the relationship with these two countries will be as important as negotiations within the EU and with the US. Dialogue and cooperation cannot be limited to climate change; they have to include other issues debated on other global governance arenas, namely world trade and intellectual property rights.

But even when the survival and further development of the international climate regime is secured, the relationship with China and India will remain important. In these two countries, coping with climate change – regarding both emissions reduction and adaptation to the inevitable impacts of climate change – will be a fundamental cross-cutting political issue. If the challenges are met, this process will bring about institutional, organisational and technological reforms and innovations that provide a common learning ground for all countries.

In order to devise an effective cooperation strategy with China and India, the EU needs to better understand how the sources of greenhouse gas emissions, their linkages to economic structures, as well as political and institutional capacity constraints in these countries determine their internal climate-related policies. The EU itself has had problems in translating goals and intentions into achievements: seven of the 15 EU members committed to the Kyoto Protocol are unlikely to reach their targets (CEC 2007).

In order to tap the potential for cooperation between the EU and the Asian Drivers, new partnerships are necessary in order to secure innovation in both global governance regimes and in institutions on a national and regional level relevant for mitigating climate change. These partnerships could be constructed in specific areas, such as research and development, and build on existing thematic policy dialogues, e. g. the Indo-European Energy Dialogue or the Chinese Commission on International Environment and Development, where European participants could coordinate their activities more actively, including their national governments and the European Commission. These partnerships

or dialogues could be used for informal debates on new policy proposals for the advancement of the climate regime, including the introduction of innovative national or regional measures (in the sense of the polyarchic regime mentioned below). Also, dialogues could be instrumental in identifying options for positive linkages between other multilateral fora and climate change and for the promotion of low carbon technologies.

In the following, we will first describe the problem of climate change, then refer to China and India as relevant actors in this problem and policy field, focus on the main characteristics of China, and finally outline the research packages and questions we want to focus on.

2 The problem

The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) issued in 2007 has made clear that time is running out if the goal of limiting global warming to an average of 2°C is to be achieved. Total emissions of greenhouse gases (GHG) should peak by 2015 and be reduced by 50 per cent until 2050 (baseline year 1990). As the industrialised countries are historically responsible for the bulk of greenhouse gases emitted, they will have to reduce their emissions by 60 to 80 per cent until 2050. Projections suggest, however, that in the absence of policy actions, GHG emissions will increase by 50 per cent by 2025 compared to present levels. Emissions in developing countries grow fastest, and after 2020, they will cause more GHG emissions than industrialised countries (Baumert / Herzog / Pershing 2005). This means that measures are needed in order to first decrease the pace of emissions growth in developing countries and second to reduce them, at least by 2050.

There are large differences both within the group of industrialised as well as developing countries regarding absolute volumes of emissions and per capita emissions. Absolute volumes are related to the size of the economy and the population: the US, China, the EU-25, India and Russia are the five largest emitters. Per capita emissions are generally higher in wealthier countries, but other factors are also important: four of the six top emitters in this category are Arab oil states, the other two are Australia (rank 4) and the US (rank 6). The EU-25 ranks 37, China 99 and India 140 (Baumert / Herzog / Pershing 2005).

Differences in per capita emissions indicate that there must be considerable differences in emissions intensity – the level of CO_2 emissions per unit of economic output – between countries. Emissions intensity is related to the specific economic structure of a country, its energy efficiency and its fuel mix, but it is neither connected to the size of a country's economy nor its population. These are the variables that have to be influenced if future emissions are to be limited; possible means are technological and organisational innovations, laws and economic incentives, and new institutional arrangements that foster social learning towards a low carbon economy.

Table 1: Greenhouse gas emissions from the US, the EU, China and India				
	US	**EU-25**	**China**	**India**
GHG emissions ($MtCO_2$ equivalent, 2000)	6,928	4,725	4,938	1,884
Per capita emissions (tons CO_2 eq.)	24.5	10.5	3.9	1.9
Income per capita (2002 $PPP)	34,557	22,917	4,379	2,572
Emissions intensity (tons CO_2 eq. / $mil. GDP-PPP)	720	449	1,023	768
% change in emissions intensity 1990-2002	-17	-23	-51	-9
Source: Baumert / Herzog / Pershing (2005)				

The risks and future negative social and economic impacts associated with global warming are a strong motivating factor for reducing the emissions intensity of economic development. Another factor is that reserves of fossil fuels are known to be finite. Securing energy supply in a growing economy is therefore inevitably linked with the promotion of renewable energy technologies.

In this research package, we will not deal with the problems associated with the development and diffusion of innovations geared towards a low carbon economy, but with the institutional arrangements conducive to it. In the following we will quickly explore some broad questions related to the global governance of climate change and then proceed with explaining the special importance of China and India for mitigating climate change. We will then briefly elaborate on possible consequences for European climate policy and finally conclude with some specific research questions that could be derived from the topics analysed in this paper.

3 The global governance of climate change and the need for a multilevel perspective

The international regime dealing with climate change is the United Nations Framework Convention of Climate Change (UNFCCC) that was signed in 1992. The Convention establishes a basis for governments and non-governmental actors interested in joint activities for the reduction of global warming and for coping with the impacts of temperature increases. The Framework Convention introduced some definitions and principles which structure the debate on what should be done by whom and how the costs should be shared. Although these definitions and principles were agreed by consensus, their practical meaning remains highly controversial. The call for 'the widest possible cooperation … and … participation in an effective and appropriate international response' is linked with the principle of 'common but differentiated responsibilities and respective capabilities', which alludes to climate being a global common whose overuse is linked

with historical disparities in development between North and South. Therefore, it is the industrialised nations who should take immediate action, while developing countries are granted a 'right to development' because growth is inevitably linked with an increase in energy consumption. The Convention also affirms the principle of national sovereignty while recalling the responsibility of avoiding damage at the transnational level.

In 1997, the Kyoto Protocol was added and signed, albeit not by all parties to the Convention (notably the US). The Kyoto Protocol establishes binding targets for emission reductions by industrialised countries (baseline year 1990) within a specific timeframe. It also introduced flexible mechanisms which allow industrialised countries to invest in emission reductions in developing countries (CDM – Clean Development Mechanism) and in economies in transition (JI – Joint Implementation), and deduct the reductions achieved from their national targets. The EU committed to a global reduction target which was redistributed in a differentiated manner within the member states, based on socio-economic criteria.

The Kyoto Protocol expires in 2012. At the last meeting of the UNFCCC parties in Bali in December 2007, a roadmap for the further development of the climate regime was agreed. Its main elements are further emission reductions by industrialised countries, real advances in technology transfer in order to support emission reductions in developing countries, a financial regime for adaptation to the impacts of climate change and incentives for reducing emissions generated by tropical deforestation. Climate negotiations have to produce the rough structure of a new treaty until 2009, so that it may become effective in 2012.

For a long time, climate change has been framed as an environmental problem, and in most countries the Convention became the responsibility of environmental ministries. This framing is not surprising as the climate is one of the fundamental regulatory mechanisms of the ecological earth system. The causal mechanisms behind climate change, however, are not governed by environmental ministries: greenhouse gas emissions are mostly related to energy use (e. g. electricity and heat, transportation and industry) as well as to land use change, agriculture and waste. Reducing GHG emissions, therefore, is directly linked with economic interests, and any policy measure proposed at the level of the Convention interfered with the core responsibility of other ministries: energy, economy, transport, trade, agriculture and forestry. The cross-cutting nature of climate change, and thus of the strategies needed to limit it, only became policy-relevant when the Kyoto Protocol became operational in 2005, after its ratification by Russia. Policies and instruments which had been prepared for implementing the Kyoto Protocol – such as the European Emission Trading System – were introduced, and their far-reaching character became clear. In many countries, this led to a reframing of the climate change problem as related mainly to energy policy, and thus to economic and technological decisions.

The cross-sectoral nature of climate change means that it requires a high degree of policy coordination on a domestic level, and that it reaches out to other arenas of global governance. This requires cross-sectoral clarifications with other ongoing global negotiation processes, e. g. the Doha Round. The provisions of the World Trade Organization and the Trade-Related Intellectual Property Rights Agreement (TRIPS) have a strong influence on climate policy instruments: the WTO for example prohibits the introduction of import taxes based on the carbon-intensity of a product because carbon-

intensity is a characteristic of production processes, not of the product. The TRIPS Agreement protects the property rights of innovation developers, which – while creating strong economic incentives for R&D – raises obstacles for the diffusion of low-carbon technologies in poor economies unable to afford the costs of technology acquisition. At the same time, the lack of international regimes in certain policy areas also creates problems, especially regarding energy and migration.

Climate change is not only cross-cutting in terms of sectors, but also in terms of geographical scales. Emissions are caused on the local level, their reduction is regulated on sub-national (e. g. in the case of some US states), national and regional level (in the case of the EU), and their effect is aggregated on the global level. The impacts of global warming occur at the local level, and there is no direct relation between locations with high emissions and with strong negative impacts: the impacts of climate change are distributed independently from the origin of emissions. The multi-scalar nature of climate change also requires policy coordination on all levels: between local communities, from the local to the sub-national and national level, on regional as well as the global level.

Policy coordination between sectors and scales is thus needed to a high degree if climate change policies are to be effective and efficient.

4 Theoretical perspectives and methodological consequences

Useful heuristic concepts and theoretical perspectives for the analysis of the institutional arrangements of climate policy can be taken from regime theory and from earth system analysis.

Political science-based research on the climate regime frames it mainly within the research on international environmental regimes. This research deals with regime formation, its attributes, consequences, and dynamics (Young 2002), and it has been strongly influenced by the dominance of neorealism and neoliberalism in the field of international relations. Actors' behaviour was analysed with the help of the concepts of power, interests and knowledge; states or governments were considered to be the most relevant actors and were treated as unitary actors making specific choices, which were determined either by power or coercion or by incentives and utilitarian calculations.

Recent results from an evaluation of 23 international environmental regimes and the compliance of 13 countries (including the US, Germany, China, and India), however, indicate that besides power, interests and knowledge, norms and path dependencies should be given much more attention for understanding how international regimes influence national policymaking (Breitmeier / Young / Zürn 2007). The reasons given can be applied very well to the climate regime:

> *"Our findings suggest that it is not helpful to assume that well-informed actors with pre-determined interests or preferences enter into agreements about environmental problems that can be understood as issue-specific social contracts. In fact, many regimes deal with issues that are poorly understood; individual members often lack both the factual information and the theoretical understanding that would be needed to forecast the probable impacts of the operation of regimes on their interests.(… Actors make the choices they do*

> *either because they represent the best alternatives … or because they constitute normatively preferred alternatives. … To be more specific … Actors often choose options that conform to the precepts of a knowledge system or a discourse that has come to dominate thinking about a particular issue … There are also clear indications that perceptions of legitimacy matter. Whether an issue arises at the local level or the global level, stakeholders who believe that the rules of the game have arisen from a process that is fair or equitable are more likely to abide by them on a day-to-day basis than stakeholders who feel no sense of ownership of the process …. Beyond this, habits or standard operating procedures play a significant role. The secret of success in most social practices arises from the fact that following the rules becomes for most participants a matter of second nature."* (Breitmeier / Young / Zürn 2007, 55–6).

The analysis of normative discourses and habits or operational procedures for understanding policy processes is especially interesting when looking at a policy field such as climate change. This policy field seems to be strongly dominated by controversies due to diverging interests and power imbalances. How to explain then the perseverance of negotiations? The norms, procedures, discourses and mental pictures of the climate regime itself may help to foster learning processes despite ongoing controversies, and induce policy coordination and decision-making processes on a domestic level conducive to the regime's objectives (see Yu 2004 for the Chinese case).

Earth system analysis provides a second avenue of thought that leads to similar recommendations. The point of departure here is global environmental change as a process that affects the fundamental mechanics of the global ecosystem as a whole. This problem definition requires a holistic approach in institutional design (of solutions) and analysis (of the causes). In terms of analysis, this means that it is not enough to analyse the dynamics of international environmental regimes at the global level or the interaction of national governments or aggregated interests which influence regime formation and implement-tation.

> *"On the contrary, a holistic view requires us to look at the full scale of institutions because all levels contribute to the holistic whole. This means … that … the structures beneath the international layer must be rediscovered, i.e. regional integration, the state, and the self-regulatory potential of societies and transnational societal actors and networks."* (Winter 2007, 2).

A holistic, multilevel perspective on the global governance of climate change does not necessarily include the vision of a global well-ordered unity. Instead, it is possible to think of:

> *"… a polyarchy of institutions located at several organisational levels, divided into many issue-related sections and dispersed over various geographical zones. This polyarchy would be self-organisational in order to reflect the common concern of preserving an inhabitable earth system …"*(Winter 2007, 2).

This polyarchic thinking may be well suited to a globalised, but still quite diverse world of different nation-states, with their own pluralistic political discourses, heterogeneous values

and norms, differing socio-economic interests, and their multiplicity of social and economic actors, their networks and path dependencies.

One methodological consequence from these two strands of thought is that in-depth studies of domestic policy processes connected with regime formation, implementation and development are highly relevant. In the case of the climate regime, this approach is even more relevant since China and India are the main new global players in this arena, and their domestic policy processes are poorly understood in the West.

Which economic and political actors and interests interfere in the formation of climate policy positions? How do they articulate their interests? Which norms and standards structure the procedures for interest articulation and aggregation? What is the importance of sub-regional differences, and do they have an influence on policy formation? How has the climate policy discourse in these countries been structured, by whom, and has it changed since 1992? Which actors are integrated in transnational networks related to climate change, and what is the influence of these networks on social/institutional learning and knowledge diffusion?

These are questions of high importance for understanding how the interrelated facts of climate change, economic growth and GHG emissions are interpreted in the domestic context and transformed into propositions for international negotiations. In the next section, we will focus on climate-related policies in China and India.

5 Understanding climate-related policies in China and India

China and India are among the top five emitters of greenhouse gases: China comes second, and India comes last in this group. In terms of population, both countries also belong to the top five. Both countries also belong to the top five countries regarding economic size: when measuring their gross domestic product in purchasing power parities, China comes second with 10 per cent of the world economy, and India comes fifth with 4 per cent (World Bank 2007).

These figures all relate to absolute **size**. They led to the strong feeling before the UNFCCC conference in Bali in December 2007 that China and India both had no reasonable argument for refusing binding reduction targets for their future emissions.

However, these figures divert attention from one fundamental difference between China, India and the other countries belonging to the top five emitters, and that is **poverty**, reflected in extremely low emission data if calculated on a per capita basis. The average emissions per capita of the developed world are 14.1 tons CO_2 eq., while the average for the developing world is 3.3 (world average: 5.6). China has a per capita emission of 3.9 tons, which is slightly more than the average of the developing world, but definitely below world average. India's per capita emission is even lower: only 1.9 tons, which locates it even below the average of the developing world (Baumert / Herzog / Pershing 2005, 22).

Clearly, size and poverty, two of the four categories mentioned in the paper by John Humphrey and Dirk Messner that make China and India special global players, are relevant for understanding their role and behaviour in global climate negotiations.

Relevance can also be attached to the other two categories – location in Asia and non-Western traditions.

Their **geographical location** is of political importance regarding climate change as well: both countries rely on the Himalayas for a substantial part of their water supply; they share borders; and they share neighbours, namely in Central Asia. Cooperation with these neighbours is formalised within the Shanghai Cooperation Organisation (SCO), which was founded in 2001 and includes China, Russia, Kyrgyzstan, Uzbekistan, Tajikistan and Kazakhstan. India has an observer status, together with Iran, Pakistan and Mongolia. While the SCO started as an organisation concerned with security and border issues, it has now extended its scope to strategic issues of economic development, including energy issues and transport networks. At the same time, the SCO receives special attention by the EU as a partner for regional cooperation, not least because of the relevance of their Central Asian members as energy suppliers. Also, these states are members of the Organization for Security and Co-operation in Europe (OSCE) and therefore have a special relationship with Europe. Depending on further developments, the SCO could turn into a sub-global arena for negotiating cooperative approaches to energy policy and thus acquire relevance for climate policy as well.

Regarding **non-Western** traditions, both countries see themselves as clearly not belonging to the Western bloc, as it is organised in the OECD, although there are nuances between both states. While China pictures itself as an alternative to the former colonial powers of the West, e. g. in its relationship with Africa, it is able to defend other positions at the same time which separate it from the G77 bloc and are clearly defined by its role as global player, e. g. in WTO talks and with regard to intellectual property rights. India aligns itself strongly with the G77 bloc, and relies heavily on its definition as a developing country, e. g. when rejecting any form of future commitment regarding its greenhouse gas emissions. Whether these self-definitions will hold in the future, during negotiations on the post-2012 climate regime, needs to be seen. It is quite likely that the smaller and poorer countries of the region will also turn to the large and growing emitters of the region as possible sources for additional funding in order to adapt to the impacts of climate change. Which strategy India and China define for the negotiations of the post-2012 regime and whether they will agree on common elements will be important for their political role in the region and on a global level.

5.1 The case of China

In the following, we will summarise some basic information on the sources of greenhouse gas emissions, climate-relevant policies and on climate change-related policy coordination in China, as published in a more detailed paper (Richerzhagen / Scholz 2007). This summary illustrates the points made earlier about the nature of the climate change problem: it is multisectoral, multilevel and multiscalar; it involves multiple stakeholders; the degree and quality of climate-related policy coordination and coherence are influenced by several factors, mainly by how the problem is framed and which actors have the political lead. A similar study on India is only in preparation, therefore we cannot present similarly detailed information on this country here.

Sources of greenhouse gas emissions: Structural economic change in China led to high economic growth rates (above 7 per cent between 1992 and 2004), growing incomes and a

higher urbanisation rate. These trends have resulted in drastic increases in energy demand, and, accordingly, in enormous increases of absolute greenhouse gas emissions. Today, China is the second largest global energy consumer after the US, but also the second largest energy producer in the world. Estimates indicate that China's total primary energy consumption will more than double between 2000 and 2020 (World Bank 2006, 50).

China is the world's largest emitter of industrial GHG emissions (Baumert / Herzog / Pershing 2005, 69). Chinese industry currently consumes 70 per cent of energy. Private households are responsible for about 10 per cent of total energy consumption, followed by transport with 6 per cent.

In today's China, almost 70 per cent of energy generation depends on coal. The dominance of coal in China's energy supply is explained not only by the country's large domestic deposits but also by coal's superiority over other energy sources in terms of cost, time, reliability, controllability and the sales potential of oil in international markets (Hatch 2003, 46). Coal releases almost twice as much CO_2 per unit of energy as natural gas and causes air pollution through sulphur and other particulates. Between 1993 and 2004, China developed from one of the world's largest exporters of coal to an importer of oil in order to meet its energy demand. According to Zhou et al. (2003), in 2020 coal will account for 54 to 65 per cent of China's primary energy use. Renewables will play only a minor role for primary energy use. These calculations point to growing increases in GHG emissions.

Policy responses: Energy policy is pivotal for emission reductions. Since 1998, the increase of China's energy supply has been complemented by measures for energy conservation and efficiency. Until 2002, China's percentage increase in energy consumption was lower in relative terms than its economic growth rate, which indicates efficiency gains. Since then, however, growth in energy consumption has been higher than economic growth (Pan et al. 2006, 18). In 2006 the Chinese government responded to this situation, defining a very ambitious target to decrease the use of energy in the *11th Five-Year Plan for National Economic and Social Development* (2006–2010). One objective was to reduce the energy intensity of the economy by 4 per cent by the end of 2006 and by 20 per cent by 2010. To advance and monitor implementation, specific targets were set for provinces and industrial sectors. In 2006, energy intensity was cut by 1.33 per cent. During the first nine months of 2007, the country's energy use per unit of GDP dropped 3 per cent (China Daily 2007).[18]

A qualitative change is starting to take hold in China with respect to the use of renewable energy, which until recently had been viewed as highly peripheral. In 2006 the Renewable Energy Law came into force; it establishes renewable energy as a top priority in China's energy strategy. It is based on the 'feed-in laws' which have successfully advanced renewables in Germany and other European countries. It aims to increase the share of

18 This may have been a result of the specific measures taken by central government to increase pressure on local governments, publishing a list of provincial regions that have lagged behind in increasing energy efficiency. In 2006, 1,008 enterprises in nine major energy-consuming industries participated in an energy efficiency program. Export tax rebates on coal, natural gas and some primary wood products were abolished and tax rebates on steel, cement, textile and non-ferrous metal were reduced. Energy prices, however, still remain disproportionately low which weakens the impact of energy conservation and efficiency policies very much (Pan et al. 2006, 14/21).

renewable energy technologies (hydro, wind, biomass and solar) in energy production from the current level of 1 per cent to 10 per cent by 2020.

In June 2007, a National Climate Change Programme was adopted (NDRC 2007). It summarises China's GHG emissions, the likely impacts of climate change, and China's ongoing efforts for mitigating climate change. In the Programme, China defines the control of GHG emissions as one of its objectives, and it enumerates the challenges this poses for Chinese economic and social development, if it wants to avoid the historical linkage between economic growth and growing emissions (NDRC 2007, 19). The section 'policies and measures' lists a whole programme for research and development in energy technology, as well as institutional reforms.

Climate-policy coordination: China's approach to international climate policy has been very cautious. In China, climate policy is viewed not mainly as an environmental problem but as a policy field with high external and economic significance. Climate policy is thus not coordinated by the environmental authority but by much more influential actors, the National Reform and Development Commission (NDRC) and the Ministry of Foreign Affairs (MOFA). NDRC is one of the most important and influential institutions in the Chinese political system. It is a macro-economic regulatory department mandated to develop national economic strategies, long-term economic plans, and national energy policy. The Ministry of Foreign Affairs (MOFA) is in charge of international climate diplomacy. In the international arena, it has been China's priority to ally with other developing countries and to speak with one voice. NDRC's and MOFA's position in international negotiations has always been defined by concerns related to economic development, energy security and the protection of sovereignty (Bjørkum 2005, 43). Both opposed any commitments not in line with economic growth, e. g. GHG emission reductions, and MOFA always concentrated on preventing the imposition of emission ceilings and maintaining a narrow understanding of the principle of differentiated responsibilities (Hatch 2003, 50). Recently, slight changes in the Chinese international position became visible in the UNFCCC conference in Bali where the responsibility for common action was acknowledged (in line with the Chinese climate change programme). This changing attitude may also be related to an increased awareness of China's vulnerability towards the impacts of climate change (Bjørkum 2005, 43).

NDRC and MOFA are also the most important actors in the National Coordination Committee on Climate change (NCCCC), China's highest climate policy-making body. It consists of 15 bureaucratic units dealing with climate-related policies and activities; it is chaired by NDRC.[19] The committee members are vice-ministers, deputy director generals of the ministries, state commissions or administrations (Nordqvist 2005, 11f.). The influence of the State Environment Protection Authority (SEPA) in NCCCC is thought to be quite weak because the institution is always confronted with the interests of strong sectoral ministries and the NDRC, which assigns lower priority to climate protection

19 Other units are MOFA, Ministry of Science and Technology (MOST), CMA, SEPA (deputy chairs), and the Ministry of Finance (MOF), Commerce (MOFCOM), Agriculture (MOA), Construction (MOC), Communications (MOC), Water Resources, State Forestry Administration (SFA), Chinese Academy of Sciences (CAS), State Oceanic Administration (SOA), and Civil Aviation Administration of China (CAAC).

(Bjørkum 2005, 44). Yu (2004) interprets SEPA's weakness regarding climate policy as caused by its failure to create specific capacities in this area.

Central authority vs. local autonomy: China is a centralised state with a strong hierarchy, including provinces, cities, counties, and towns, but central government has far less influence on the provinces than one would expect. Decentralisation has been initiated with economic reforms, and local governments have been granted considerable economic and financial power. They have a certain authority over local industries and financial resources on the local level (SEI / UNDP 2002, 68). This degree of local political autonomy, together with China's size and complexity, make it difficult for central government to oversee the course of actions on the local level. Often, local officials are overwhelmed by their tasks because they lack training and access to new laws and regulations and the capacity to interpret and implement laws (SEI / UNDP 2002, 78). In addition, China's reforms have strengthened profit orientation in the industrial sector, and economic growth has entailed adverse environmental impacts. Local governments thus face a conflict between economic and environmental aims and usually give priority to economic development of their region, postponing environmental recovery to the future.

6 Research packages and questions

From what has been said until now we can derive two main research packages. The first package would focus on the internal structures, dynamics and processes that determine greenhouse gas emissions and that influence or shape climate-related policies on a domestic level as well as the positions of the Asian Drivers in regional and global negotiations. This package would refer to the economic and political 'needs and motivations' (cell 5 in the diagram contained in the paper by John Humphrey and Dirk Messner) which have to be recognised when involving the Asian Drivers in innovative climate change initiatives. A similar analysis of the determining factors of the EU's climate policy also belongs to this package.

The second package would focus on the negotiation process for the post-2012 regime, on the needed linkages with other global governance arenas and on the likely new lines of conflict and interest constellations which will emerge in global politics (cell 7 in the diagram contained in the paper by John Humphrey and Dirk Messner). Here, it will also be possible to analyse reciprocal perceptions of actors involved in the EU, China and India during the negotiation process as well as ongoing initiatives for dialogue and cooperation.

Linkages between both packages should also be explored, one hypothesis being here that regime formation is at least partially an iterative process where domestic policy development influences the development of international regimes and vice versa. Another hypothesis would be to focus on regional or transnational actor networks and their influence on policy formation.

In both packages it makes sense to use the categories which characterise the nature of the climate change problem: multisector, multiscalar, multilevel, multiple stakeholders within public administration and civil society.

Multisectoral drivers of climate change (package one): The economic drivers of greenhouse gas emissions in China and India and the most relevant economic sectors stand in the centre of attention. While the innovation research package focuses on these driving

forces and relevant economic sectors from the perspective of opportunities for a low carbon development path, our focus would be on the necessary regulations, the environmental parameters shaping them and the political interests defending or opposing them. Major questions include:

– What are the sources of emissions, how are they related to economic growth, which are the bottlenecks for reducing them?
– What is the relationship between climate policy, environmental policy and economic growth?
– What kind of strategies are the Asian Drivers developing in the climate policy arena (and related fields)? What do we know about the strategies, and how they are changing?
– What are the factors which determine climate change policy and implementation in China and India, and how are these changing?
– To what extent does our four-fold characterisation of the specificity of the Asian Drivers identify the key factors and dynamics in the domestic and regional climate policy arena?
– What is the significance of a growing awareness of the likely domestic impacts of climate change and the difficulties in adapting to them for policy development?

The multisectoral perspective is also relevant for answering the following question from package two:

– What are the critical areas for European policy around global governance and climate change over the next five years?

Multi-actor perspective (packages one and two): The main objective is to identify the main relevant regional, national and local actors in China and India, as well as in the Asian region, and transnational actor networks which play a role in linking the EU with China and India. Major questions include:

– Which actors advocate a proactive policy or strategy for mitigating climate change?
– Which are the procedures for policy coordination, which factors determine their effectiveness and how are they changing?
– Which networks on domestic, regional and transnational level are important promoters of learning processes?
– Which actors determine climate change policy and implementation in China and India, and how are their attitudes changing?
– To what extent does our four-fold characterisation of the specificity of the Asian Drivers help to identify the key actors and understand their behaviour?

Multilevel perspective (packages one and two): Here the focus would be on the feedbacks between policy formation and implementation on the sub-national, national, regional as well as global level. The EU as a body with highly developed and differentiated procedures for multilevel governance is an interesting case in itself and could inspire policy coordination and implementation in large and diverse countries such

as India and China. Cooperation and dialogue initiatives between levels and regions could also be analysed here. Major questions include:

– How does policy coordination and implementation in climate-related policy fields develop in China and India? What are main obstacles or positive learning experiences?
– How is climate policy formation developing in the EU in 2008 and 2009?
– What are the linkages between energy policy cooperation and the emerging post-2012 regime in the Shanghai Cooperation Organization?
– What is the potential for an EU engagement with China and India to influence these policy-making and implementation dynamics?

Multisectoral climate-relevant policies at the international/global level (package two): Here the focus would be on the climate policy arena as such as well as on the linkages with other global governance arenas such as the WTO (emission trading, property rights and technology transfer), international energy policies (Shanghai Cooperation Organization; International Energy Agency), the climate-related role and policies of the World Bank, the Asian Development Bank and possibly the European Bank for Reconstruction and Development (which is an important actor in Central Asia); the role of the Asian Drivers in the debate on the climate-related reforms of the UN system (future of United Nations Environment Programme [UNEP], United Nations Development programme [UNDP], Global Environment Facility [GEF]). In each case, the focus would be on the role and initiatives of the Asian Drivers as well as on the challenges and opportunities for the EU. All these arenas will be relevant beyond 2009. Major questions include:

– How have China, India and the EU positioned themselves in international negotiations on the post-2012 regime?
– How far were they able to shape the regime according to their expectations? Which interests and power constellations does the agreed regime reflect?
– What kind of long-term strategies are the Asian Drivers developing in the climate policy arena and other related global policy fields? What do we know about the strategies, inter-linkages between them and how they are changing?
– To what extent does our four-fold characterisation of the specificity of the Asian Drivers identify the key factors and dynamics of their strategies in the climate policy arena?
– How do we transfer the debates on diverging macro scenarios for global governance and Asian Drivers to climate change issues?

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V What next? How to organise the research we need?

Hubert Schmitz

There is little doubt that the rise of China and India presents major new challenges for Europe. The preceding papers by Altenburg, Humphrey, Messner and Scholz go straight to the frontiers of knowledge and identify the questions which future policy-oriented research needs to address. They have been particularly concerned with the rise of China and India as innovation powers and with their increasingly important role in finding solutions to global climate change. As set out in the introduction, in both these fields, European business and policy needs to address issues of conflict/competition but also find ways of working together with China and India. And both fields are related to each other in that innovative capacity is essential for mitigating climate change. Ways forward require the ability to define the issues clearly and see them from both the Asian and European side. This is what the preceding papers sought to achieve. The purpose of this final paper is to discuss how we can move this agenda forward. It asks how can the proposed agenda be researched and acted upon in an effective way?

To this end, this paper pulls together the lessons from our previous work. It then turns to the future, focusing on issues of research governance. Which way of organising the research is likely to address the new challenges effectively?

1 What are the lessons from our previous work?

This section draws on our experience to date in research on the Asian Drivers of global change. The experience in this and related fields of policy research helps to identify the key challenges which future research needs to address. These challenges are all about overcoming divisions between different specialisations and bringing about new forms of interaction: between researchers from different traditions, between researchers and policy makers, and between Asia and Europe. The subsequent section will then discuss alternative ways of organising future research and funding: the central proposition is that the governance of research and funding has a major impact on whether research challenges identified in this section can be addressed successfully.

2 Internal dynamics and changing external impacts

Much attention has been given in recent research to the impact of China (and to a lesser extent India) on the other parts of the world. Much progress has been made in understanding both threats and opportunities and unravelling the many different ways that China and India impact upon other countries. The main weakness in this work so far is that insufficient consideration is given to how these impacts keep changing as a result of rapid changes within China and India. And little consideration is given to how engagement with China and India can substantially change these impacts.

This may seem an obvious and predictable problem but it can be explained easily. While the rising Asian powers have attracted enormous attention worldwide, research has been

fragmented. Our participation in numerous workshops and conferences suggests that researchers tend to be good at either understanding developments internal to China and India or observing the repercussions of these developments for other countries, but very few have the capability or resources to bring the two together.

The implication for future research on the impacts of the rising Asian powers for Europe is clear. It will need to be research on *their internal dynamics and the changing external impacts*. It is very difficult for individuals to achieve this, but a network organised around the connections between these two issues can live up to this challenge.

3 Integrating different competences

It is widely acknowledged that researchers in both natural and social sciences tend to be overspecialised and that the disciplinary divides stand in the way of providing a better understanding of the world and providing insights which are relevant for policy.

This is particularly so in the issues which are of central concern to this workshop. Take the case of China's role in mitigating climate change. It requires bringing together expertise in climate science, global governance and China' internal governance and politics (Richerzhagen / Scholz 2008). Or take the case of India's and China's advances in innovation. These advances cannot be assessed and understood by using only an innovation systems approach. As set out in the background paper by Altenburg / Schmitz / Stamm (2008), one needs to combine different approaches (national innovation system, global value chain, and other approaches). Integrating them is difficult because each specialisation has its own concepts and its own ways of ordering (or ignoring) the world. Even communication can be difficult, let alone working together on a common problem. Private companies have recognised that advancing in global competition requires integrating different competences and promoting learning across different subsidiaries, and that this in turn requires managers capable of bringing these competences together. The same applies even more in research on the issues which are the focus of this workshop.

4 Observing through two (or more) lenses

Another lesson from the work to date is that the same issue is often perceived in very different ways, depending on whether it is seen through an Asian or European lens. European observers stunned by the speed with which China burst on the global scene, find it difficult to believe in China's own image of this process as 'peaceful rise'. The importance of adding a Chinese lens to European analysis is shown by the work of Gu / Humphrey / Messner (2008) on the implications of China's rise for global governance. The paper brings home that the Chinese approach to international relations is characterised by:

– Interdependence. China sees its increasing participation in world trade as entirely in harmony with the globalisation process.

– Identity dilemma. While recognising its economic power, China sees itself as a newcomer that has to learn and observe how to operate in international fora.

– Pragmatism. Aware of its own vulnerabilities, China's global self-presentation is cautious and reactive – suiting an ingrained cultural style.

For Western analysts such perceptions are difficult to understand when they observe the operations of Chinese companies in the world which are often anything but cautious and reactive. The key here is that we can no longer equate the views and actions of the Chinese government with that of Chinese companies. The private sector is outstripping the capacity of the government to control it. This makes it even more difficult to understand to what extent Europe can put pressure on China to devote more attention to its global responsibility. For the time being, researchers and politicians need to recognise:

> *"… the collective mentality of a country anxious not to make the world afraid of it, while it pursues a pathway of rapid economic development. However, China is simultaneously a country with a colonial history and a firm unwillingness simply to accept Western moral and political hegemony. Intercivilisational equality and mutual respect are not merely code-words for peace. They also imply that mutual respect and the importance of avoiding conflict should involve the notion of 'minding one's own business."* (Gu / Humphrey / Messner 2007, 10).

This passage seems highly relevant to understand recent tensions between West European and Chinese politicians. Interestingly it comes from the Chinese co-author of an insightful paper which shows the gains (and the pains) of collaboration between European and Chinese researchers.

5 Big differences between China and India

China and India have important features in common: big economies, long periods of very fast growth, huge populations, hundreds of millions remain poor. There are thus important reasons for analysing them together, as we have done in much of our work on 'Asian Drivers'.

But there are also important differences:

– The Chinese economy is deeply integrated into the East Asian production systems and the world economy. By comparison, the Indian economy is still inward oriented (the main exception is the software industry).

– The legitimacy of the Chinese government – at central and local level – seems to depend on continuing fast economic growth. In the Indian case, this is much less so.

– While growth continues, the Chinese government has greater power to invest enormous financial resources and to enforce change from the top than the Indian government; however the increasing power of local government in China means that this difference diminishes with time.

– With regard to international orientation, India sees it itself as a developing nation strengthening the influence of the G77 whereas China sees itself as an emerging global power.

These differences between China and India affect not only the internal dynamics in these countries but also the prospects for and types of international cooperation.

From a research point of view, the differences need to be kept in mind because they increase complexity and thus make research more difficult. But they also offer an opportunity: the possibility of meaningful comparison. Organising such comparisons is a task for future research. Equally, exploring how the interplay of China and India affect Europe is important.

6 Constructing common interests across the current divide(s)

A continuation of current trends leads to competition and conflict between Europe and the new Asian powers. Attempts to avoid such conflicts have concentrated on negotiating targets – in particular with regard to climate change. Targets for reducing carbon emissions are the centre of attention. If agreed and complied with, they would indeed make a significant difference. The objective is clear but ways of achieving it are not. It remains uncertain how much governance through global rules can achieve. One of the main problems is that it pitches the battle lines in terms of China (and/or India) versus Europe or Europe versus the United States of America.

Future research needs to pay more attention to the battle lines within these countries and to the possibilities of constructing common interests across the current divides. It would mean shifting the debate to governance through global relationships.

Take the example of energy efficient technology. German firms are amongst the leaders in this field. German technology institutes are connected to these firms. Chinese firms and technology institutes are keen to cooperate. Identifying existing and potential alliances and exploring how they can be strengthened is an important task. The hypothesis is that constructing common interests across the Europe–Asia divide and across the public–private divide is an important way forward. If this is so, political science expertise will be needed to analyse state–business relations at both the national and international level. The key point is that expertise on the politics of national and international policy making needs to be added to technical and economic expertise.

7 Connecting research and policy

The purpose of the research in question is to influence policy. The expectation is that the research contributes to policy formulation and that the proposed measures are then taken up by those in power. Both the DIE and IDS have a long history of contributing to policy making in this way. This route and sequence does however have its limitations. It is based on a linear process of the policy making process.

In our experience there are other important ways in which our research can influence action: by changing the ways issues and priorities are perceived, by framing agendas for action, by becoming embedded in an institution which serves as a source of ongoing influence. For all these modes, it is useful to write outputs which are specifically addressed to the policy making community. Producing policy briefs which distil policy lessons are essential instruments.

All these ways of connecting research to policy are important but not enough. In the fields of innovation and climate, the questions to be addressed change rapidly. Researchers typically take the lead from literature when defining their research questions. This ensures academic acceptance but induces time lags which render much research irrelevant for policy making in government or business. Shortening the cycle is possible by arranging extended meetings between researchers and government officials from relevant Ministries. The German Development Institute has experimented with this to mutual advantage. The key point is to bring the policy makers into the early stage of carrying out the research and not just at the end. Making such arrangements is difficult to justify for an individual researcher but becomes more feasible if organised for a group of researchers.

There are thus ways of bringing policy concerns early into the research process. The challenge does not stop there. As stressed earlier, perspectives on these policy concerns often differ between old European and new Asian powers. Mutual understanding will require more collaboration between researchers from both sides and this collaboration can then feed into the policy process. All this is difficult to achieve and requires investment. Perhaps the most promising way of achieving this is to target the young/future decision makers (30-40 year old).

8 Finding a way forward

Like many other branches of economic activity, the research business is affected by frequent changes and fashions. It is however safe to predict that the issues raised in the preceding papers will be with us for a very long time. It is also safe to assert that the research cannot be carried out by European researchers on their own – nor by Asian researchers alone. Collaborative research is needed but genuine collaboration is notoriously difficult. This final section therefore reflects on how best to organise internationally collaborative research. Discussions on the 'HOW?' rarely receive sufficient attention. We mean here not detailed research methodology but the governance of internationally collaborative research. This is not just an add-on, the governance of research and funding has a major influence on the kind of insights and findings one can expect to come out of the research.

9 Governance of research: a new constellation of actors in research

Organising research on the implications of the rising Asian powers for Europe is different from conducting research on say Germany–UK relationships or even Europe–USA relations. Lenses, conceptual frameworks, actor constellations, previous research experience, research-policy nexus, funding environment tend to be much more similar across Western Europe and North America. While always challenging, one can get on with the business of organising the research fairly speedily without too much concern of equal partnership. A clear indication of this is that leading research institutes are often happy not to be the convenors of cross-national research programmes so as to avoid the high transaction costs of coordination and be able to concentrate on the research itself. Note that they are only likely to relinquish the convening role when they feel that partners with similar competence and intellectual frameworks will be 'in charge'.

Research collaboration involving the new Asian powers and the old European powers also has different characteristics from research in the field of development studies that brings together OECD and developing country researchers. The latter has tended to proceed in post-colonial fashion with Europe (or the United States) setting the agenda and providing the funding, while developing country institutes are subcontracted to provide the country-specific data. There are significant attempts to change this but the post-colonial mindset and research organisation continue to prevail, with most developing country researchers reacting to and feeding into agendas set by their European colleagues.

This pattern of working is completely unacceptable to the research institutes in the rising powers of Asia. It is also negates the changes that have occurred in the real world where the (former) 'periphery' has begun to drive the changes in the (former) 'centre'. And it is counterproductive: if indeed the solutions to the big challenges lie in international cooperation, then the research needs to be organised in a way which enhances equal partnership.

10 Alternative ways of organising the research

When reflecting on the pros and cons of different ways of organising internationally collaborative research, it helps to specify whether one is dealing with a project or programme (consisting of many projects) and how experienced the participating researchers are. Let us assume for the purpose of the discussion that we are dealing with a sizeable postdoctoral programme and that the researchers come from China, India and Western Europe.

In principle there are two ways of organising such a postdoctoral programme. There is first the open competition–lean management model. The grant-holder becomes an intermediary of the funding organisation(s) and has the tasks of:

– defining the research agenda and parameters
– advertising/inviting applications from around the world
– selecting the most promising proposals/candidates
– bringing the researchers together for two or three workshops to exchange experience
– ensuring that each researcher publishes his/her own findings
– producing a collective volume containing the best contributions.

This way of organising a research programme is transparent, relies on the ambition of the individual researcher to publish and provides an organisational (and sometimes also intellectual) framework so that the individual researcher is not entirely isolated. The costs for management are low, concentrated on the tasks of holding a few workshops and monitoring quality and time schedule. Quality will inevitably be uneven but the chance of some excellent contributions is high. And critically, the researchers define the questions to be answered. Within the broad parameters of the programme, the researcher is in control of the agenda. In order to ensure that both Asian and European perspectives have equal chances of obtaining support, the selection committee would need to have composition of something like one Chinese, one Indian, one German and one British senior researcher. Similarly, referees would need to come from both the Asian and European side.

There are clear strengths to this way of organising the research. There are also weaknesses. It is very difficult to bring together researchers that have started by developing their research agendas without reference to each other. And institutional, as opposed to individual, development would remain limited.

One way of addressing these problems would be a more actively managed research programme. The main reasons for intensive management would be to foster the interactions that otherwise might not occur:

– integrating different competences (disciplines, sectors)
– combining Asian and European perspectives
– making connections between different dynamics
– developing an evolving research agenda over time that reflects an increasing mutual understanding of key research issues between researchers in different countries
– facilitating and maintaining continuous interaction between policy makers and researchers.

Managing this process means much deeper involvement of senior staff in the research process, for example organising mini teams that make direct comparisons, organising meetings with policy makers, ensuring that researchers from different disciplines interact and do not give up when they run into problems, or mediating intercultural difficulties. All this means substantially higher management costs, enormous dependence on the skills of the research managers, considerable interdependence between researchers (loss of autonomy), and more friction between the researchers. It also means that more time is needed to conduct the research because collaboration is time consuming. The costs are higher than in the first model but the chances of capturing the connections and interactions neglected in most current work are also higher.

These considerations help to identify the questions to be addressed by those concerned with funding or setting a research programme on the implications of the rising Asian powers for Europe:

– What are the strengths and weaknesses of the outlined ways of organising a research programme?
– What would be the appropriate forms of managing the research programme – in other words, what would be the appropriate governance structure for research collaboration? To what extent can the research process be managed? What is the skill profile of the manager(s) that would be needed?
– Should there be open recruitment or targeted recruitment from a very small number of partner institutes?
– If a strategic partnership model is chosen, how should the allocation of resources be decided?
    - Equal allocation of postdoctoral fellowships to each partner?
    - According to financial need (low in the case of partners that are state funded, high in the case of self-funded organisations)?

  - In accordance with quality of submitted proposals judged by a management committee?
- How many years should the postdoctoral projects last? In the first model? In the second model?
- Should cross-national collaborations form an important part of the research?
- How strong should the comparative approach be? Should one build trilateral teams focusing on the same topics? Or be more flexible in order to capture country-specific issues?
- Is it necessary to have one organisational approach for the entire postdoctoral programme? Is it better to identify different bundles of research questions and then organise the research in accordance with the research questions and in accordance with preferences and capabilities of partners?
- Which is the most effective way of organising the research-policy interface? Who would be the most appropriate partners for this in Europe, China and India?
- What is the best way of providing Asian scholars with an experience in European policy making bodies?
- What is the best way of providing European scholars with an experience in Asian policy making bodies?
- It is generally assumed that Asian scholars are fluent in English. Should European researchers learn Chinese? India is so much easier in this respect for many European scholars, but it is China that has attracted most attention by European researchers.
- What can be learnt from industry about organising research networks across intercultural divides?

The Institute of Development Studies and the German Development Institute have some experience of managing international research consortia and addressing the issues of governance and mutual capacity building. This experience shows that there are trade offs that need to be considered from the start. Is the priority:

- Excellence in research (publishing in refereed journals) or mutual capacity building?
- Excellence of research or equality amongst the partners?
- Speedy research results or building long-term relationships between people and institutions?

These trade offs do not arise necessarily but it is useful to keep in them in mind when setting up internationally collaborative research dealing with the big questions identified in this paper.

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