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# SERIE RESEARCH MEMORANDA

Global Trends and Climate Change Policies

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# Global Trends and Climate Change Policies

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## 1. Introduction

This chapter aims to map out the drivers which are likely, from a global perspective, to exert an anthropocentric impact on climatological conditions in our world. It does so by identifying megatrends with respect to institutional change, internationalization and economic integration, technological progress, developments in transport systems, demographic transformations, cultural change and shifts in international business strategies. The chapter also assesses the relevance of these megatrends for designing and implementing internationally co-ordinated climate change policies.

The idea of sustainable development as a policy and analytical concept is very much 'en vogue' nowadays. It has led to numerous policy initiatives and an avalanche of literature (for an overview, see Van den Bergh, 1996). Sustainable development will not arrive like 'manna from heaven', but requires changes in behaviour, economic mechanisms, institutions and technology (see e.g. Ayres and Ayres, 1997). In this context, technological change towards environmentally-benign modes is often regarded as a *sine qua non* (see e.g. Dosi et al., 1990; Lundvall, 1992). Major impediments to these transformations are often inertia and a lag in adoption

mechanisms for environmental technology as a **result** of lock-in structures in path-dependent systems. This naturally has serious implications for an effective and proactive sustainable policy at **all** levels from local to global. All this is especially cogent for climate change. Despite the awareness of the potential severity of the climate change problem, its 'remote' nature often provokes insufficient policy action and public support at local or national levels. Local quality of life often comes higher in the hierarchy of needs than climate change.

In general, the transboundary character of many pollutants creates the need for an international regulatory system for spatial externalities. The emergence of international environmental agreements is closely linked to the recognition of a collective problem which cannot be solved by means of segmented or individualized national or local policies, or even by bi-lateral co-operation. The traditional economic wisdom on how to cope with environmental externalities fails in the case of transboundary pollutants because of differences in regulatory and legal systems, problems with identifying and addressing polluters (especially when there are many of them), high transaction costs in implementing policies and differences in the economic interests of the countries or stakeholders involved. The complex nature of global environmental change therefore calls for effective policy mechanisms of a transnational nature, as is evidenced by the current climate change initiatives – and frustrating results – following the Kyoto Protocol.

A change towards more sustainable modes of production, consumption and lifestyle, which are also in harmony with the objectives of climate change policy, would require various institutional, technological and behavioural adjustments or innovations. But such changes cannot be implemented at once in all regions of the world. As a consequence, we will face a first-comers versus late-comers dilemma (see also Castells and Nijkamp, 2001), a situation which previously emerged in Europe after the adoption of the agreement on Long-Range Transboundary Air Pollution in Europe. Now that we seem to have sufficient scientific evidence to justify and support strict climate change policies, the question is what insights are needed in the areas of economics and social sciences to support the international climate-policy-making process. Given these observations, this chapter addresses just a small number of aspects of the required insights, namely those related to the interface between more or less autonomous global trends and the necessary changes in climate change policies. The focus will in particular be on those megatrends which may be directly or

indirectly conducive to or thwart attempts to combat climate change. We argue that an institutional re-design of the governance structures of climate change may be needed to ensure long-term sustainable development.

## 2. The Human Activity Space in a Global Perspective

Ever since the world began mankind has seen its task as being - or has been forced - to expand its action radius in search of new development prospects. The present age of globalization is essentially the latest stage in the long history of civilization, which will be marked by intensive (physical and virtual) interactions on a world-wide scale. Globalization has become a fashionable term in policy discussions and in the scientific literature, used as a concept that refers to structural transformations in our economy through which economic activities are not only connected to their local base but are linked at a global level by means of various ramifications of a political, socio-cultural and economic nature. This interface between patterns of local activity and global developments is a complex phenomenon which has only recently become the subject of scientific investigation. Gaps in knowledge are thus inevitably abundant and much research would be needed to offer a satisfactory and complete picture. Even scarcer is insight into the intricate relationship between changes at the global level and their implications for the environment, not to mention changes in the climate on our earth. There are evidently multiple interwoven forces at work (such as internationalization of markets, accelerated development and diffusion of technologies, world-wide communication and mobility, uniformity in consumption patterns and lifestyles, alliances of globally-operating firms and 'nomadic' behaviour by firms on a world-wide scale), which may act as both causes and consequences of globalization at various geographical levels and on different time-scales (cf. Van Veen - Groot and Nijkamp 1999, 2000).

An important structuring factor from a global perspective is the change in the institutional mechanisms shaping our world economy, such as the World Trade Organization (WTO). Despite much criticism, each country wants to be a stakeholder in such organizations for the sake of prestige and the economic benefits. The same holds for the IMF, the OECD and the World Bank. But these organizations have not played a dominant role in environmental or climate policies. The UN has become more or less the advocate of sustainable development on a global scale, but has manifested insufficient power to enforce strict legislation, as has been witnessed at

many recent climate conferences. Hence negotiations take a long time and often lead to disappointing agreements with a low profile. Short-run interests seem to play a more important role than long-term benefits for society at large. The pace of development and implementation of international environmental and climate policy is therefore slow due to a lack of political will (or courage) and social acceptance. As long as there is no international 'carrot- and-stick' system for enforcement of adherence to globally accepted environmental standards, it will be hard to develop successful strategies for climate change. International environmental and climatic governance is thus a major challenge from an institutional perspective.

Clearly, a multi-faceted phenomenon like globalization will have a multiplicity of environmental and climatological implications. Although many aspects of these implications have been studied in recent years, it was often in a fragmented manner. An OECD (1997) study distinguished four different effects:

- **scale effects:** globalization will lead to larger world output;
- **structural effects:** globalization will generate shifts in the composition and location of production and consumption activities;
- **technology effects:** a competitive world will promote different technology paths ;
- **product costs:** in a growing world economy different product mixes will be produced and consumed, reflecting regional differences in product combinations in relation to different adoption patterns of new technologies.

It seems plausible that the effects - individually and in combination - will have important consequences for our physical world, in both the short term and in the long run. Such effects may be devastating for sustainable development, but may also create new opportunities for environmentally-benign modes of living, working and producing (as can be seen in the environmental Kuznets curve; see De Bruijn and Opschoor, 1997). It should be noted that the implications of these four types of effects for the emission of greenhouse gases in the long term are not at all clear, given the overwhelming uncertainty about the impact of new environmental technologies and technological advances in general. Furthermore, even if it were possible to estimate the extent to which global warming will take place , its effect on the stability of ecosystems and on the climatological system is hard to assess. What we nowadays observe in research and policy practice is a reliance on scenario analysis, which might give the false impression that greater certainty is being created. But in a way scenario

analysis takes uncertainty almost to its extremes, since a scenario is only a feasible – but certainly not by definition a plausible or probable – future image. A scenario is essentially part of a learning model, which acts as a sort of flight simulator for policy-makers training them to cope with uncertainty, rather than an empirically-tested assessment tool that can be used for future predictions.

The overwhelming use of scenarios in climate change analysis is thus a clear reflection of the absence of sound knowledge of future empirical states of our world (e.g., in terms of technology, international co-operation.). It therefore makes sense to offer a qualitative, systematic overview of global megatrends which will most likely have an impact on the volume of greenhouse gases and hence on our climatological system, without knowing whether such changes are good or bad for society or the environment. Such an attempt will be made in the next section. We will then try to systematically assess the implications for the design and implementation of an international climate policy by offering a list of qualitative drivers.

### **3. Megatrends in a Global Village**

#### **3.1 Introduction**

The past decade has witnessed a vivid debate on various questions relating to climate change. For example, is the climate changing (e.g., what are the relevant indicators and on what time-scale?). If it occurs, will climate change manifest itself equally in all regions of our world (e.g., is there an equity issue involved in the effects of climate change?). If it exists, will climate change follow its own natural long-term cycle or rhythm (e.g., is human behaviour a factor in climate change, and if so, to what extent?). Last but not least, is climate change good or bad (e.g., would it have unforeseen benefits, in temperate or cold regions for instance, in addition to costs?). A consensus is gradually emerging among climatologists that the role of the emission and concentration of greenhouse gases is not neutral in climate change, irrespective of whether those greenhouse gases can be absorbed by natural long-term adjustment mechanisms in our climate system. There is complete agreement that a rise in emission rates of greenhouse gases such as CO<sub>2</sub> is a direct effect of human activity. It is therefore important to identify classes of driving forces of an anthropocentric nature which have an impact from a global perspective on the production, emission, distribution and concentration of such greenhouse gases. It should be recognized that the sources of the man-made contribution to climate change are to be found in the

behaviour of some six billion inhabitants of our earth, all of whom have totally different lifestyles and consumption and mobility patterns and whose geographic distribution is unequal. It would require a massive research effort to identify the drivers of micro-behaviour of so many people. However, the earth's ecosystem is an interwoven system at various levels, so that local activities ultimately have an influence - directly or indirectly - on the global environmental system. The same applies to local economic activities in a particular region, which are - directly or indirectly - influenced by or have an influence on the world economic system. Against the background of this concept of a 'global village', it seems fair to state that world-wide human activities are not neutral regarding man-made factors in our climate system. This calls for the collection of up-to-date databases on human activities and environmental implications on a spatially differentiated scale (for empirical data, see e.g. Stanners and Bourdieu, 1995).

From an international perspective, it is possible to distinguish megatrends which are likely to act as drivers for the occurrence of global warming. The list is almost endless, and depends on the disciplinary angle taken, which may range from ethics to astronomy. In the context of the present paper, we have selected eight driving forces which are directly linked with human behavioural patterns. The megatrends that we discuss here are:

1. institutional change
2. internationalization and economic integration
3. rapid technological progress
4. the emergence of a knowledge economy
5. improvement of logistic and transport systems
6. demographic developments and transformations
7. cultural shifts
8. international business strategies

### **3.2 Institutional change**

Particularly since the end of the Cold War, governments around the world have resorted to market forces to improve the functioning of their economies and the efficiency and quality of government services and utilities. The facilitating processes of liberalization and privatization involve radical institutional changes at global, regional, national and local levels. Older, more rigid institutions and structures are

being replaced by new ones to create new markets or improve the functioning of existing ones. The greatest institutional change can be witnessed at national level, the former centrally-planned economies being the prime example. Regional organizations, such as the European Union and the North American Free Trade Agreement have also moved with the times. Institutional change in the international organizations that have been established since the Second World War to facilitate and govern global economic integration is clearly proceeding at a slower pace. The IMF and the World Bank have always been fervent promoters of market forces, but a further liberalization of world trade through the WTO seems to have been blocked by political opposition from various directions, while the Multilateral Agreement on Investments, negotiated under the auspices of the OECD, has been terminated. As already mentioned, however, it has to be acknowledged that the process of building global environmental institutions is proceeding even slower. In addition, national environmental policies and the design of international environmental policies increasingly interfere with existing international regulations and agreements, such as those relating to international trade, investment and economic integration. Institutional renewal at the global level encounters serious economic and political obstacles, mainly due to North-South contrasts and political tensions in the North between the USA and the EU. The undesirable result is that international economic relations can develop undisturbed, without adequate backing and regulation by an international system of environmental governance. Corporate climate governance will take a long time to develop. Emerging institutions and regulations will evolve as a response to the severity of the problem and world-wide awareness of the climate issues.

### **3.3 International economic integration**

Our world is moving towards a complex network economy, in which economic interaction at a global level is gaining in importance. Liberalization of international trade – under the influence of the WTO – is but one example; we see similar developments on a regional scale in the EU, ASEAN, NAFTA, MERCUSOR and Australasia. As trade barriers vanish there is more scope for international trade and foreign investments, which will undoubtedly increase welfare in all the participating countries. For quite some time now world trade has on average been rising even faster than the domestic production of many countries. The upward trend

in international trade relates not to only goods or services but **also** to foreign investments (since the 1990s). Competition (product and **price** competition) is obviously **fierce** on **many** domestic **markets** nowadays. Consequently, the production – consumption – waste chain is not only **tending** to become **longer**, but **also** more international. For example, the **average carton** of yoghurt – which could in **principle** be **produced** by the local economy – **needs** the trade involvement of some six countries.

From an **economic** perspective, international trade and product specialization can be ascribed to **comparative costs** and natural resource availability, although this explanatory model has to be supplemented with elements from the theory of product specialization and monopolistic competition (Dixit and Stiglitz, 1977), technological regimes (Dosi et al., 1988) and agglomeration **economies** (Fujita et al., 1999). This trend of international **economic** integration is facilitated by **changes** in industrial economics which point to the **importance** of the global ‘**components**’ industry (Legendijk, 1995). Investment flows have followed the world-wide mobility drift; they are not substitutes for international trade, but in **fact** tend to **promote** the increase in international flows of goods. International capital **markets** are nowadays developing at a rapid **pace** and have a **decisive** **influence** on the **fate** of national **economies**. International monetary integration, particularly in the EU, is another facilitating factor in this respect, as it **contributes** to the rise of integrated goods and financial **markets**.

In conclusion, internationalization of business life is a major trend in a modern network economy. The decline in domestic protection and the **access** to international **markets** have induced world-wide growth in trade and investments, accompanied by the emergence of the component industry through which goods have become part of a transnational production chain.

The implications of an open world economy for environmental quality do not seem to be favourable (see for example e.g. Copeland, 2000). Clearly, for an **economist** this is a problematic issue, since the theory of trade teaches us that there are gains to be made from trade as a **result** of spatial specialization. But the resulting trade **may** overall be detrimental to the environment. In **any** case, increased trade-related transport generates more pollution. The recent discussion on ecological footprints has highlighted **many** anomalies in our belief in the benefits of the exchange of goods (see Van den Bergh and Verbruggen, 1999).

### 3.4 Rapid technological progress

Since the 1980s, technological change has played a more important role in increasing the competitive advantage of nations and regions. Technological progress has become a vehicle for accelerated growth of productivity and has laid the foundations for a world-wide increase in welfare. The economic and monetary integration and the challenges of intensified global competition have clearly increased the pace of innovation and diffusion of new products and services. A notable driver in this process has been the emergence of increasing returns to scale, which may facilitate a higher growth path, apart naturally from the cyclical business patterns inherent to market economies. For economic and strategic reasons, research and development efforts are increasingly concentrated in big firms operating internationally. The industrial organization features a mix of outsourcing, mergers, take-overs and strategic alliances. The most dynamic technological clusters include ICT, biotechnology, materials technologies, micro-mechanics and nano technology. The ICT sector has proved to have its own indigenous growth pace and welfare-enhancing impacts, but the technology has also had a pervasive effect through its benefits for other technologies (e.g., aeronautics).

The production and diffusion of new technologies is clearly not location-independent. There appear to be locations which offer excellent seedbed conditions for new technologies, such as Silicon Valley. Although some technologies are in a strict sense footloose, the local business culture and sense of entrepreneurship nevertheless leads to site-specific incubator patterns of technological change. This all has important consequences at both local and global levels. Technology has become an international good (witness the 'human genomics' project). Often, the main question concerns the conditions under which technology will be rapidly adopted and which countries or regions are the forerunners.

An important question in the era of ICT is whether these technologies will act as a substitute for physical movement. If so, ICT could be a 'deus ex machina' for climate policy. But despite several – often popular – claims for the potential of ICT, it has to be noted that the empirical facts do not provide convincing evidence. There is indeed some substitution, but this is usually more than offset by the generation of new movements (for the facts, see e.g. Salomon and Mokhtarian, 1997).

The knowledge economy, on the other hand, may act as a facilitator of environmentally-benign behaviour and lifestyles. More information may increase awareness of the threats of climate change and speed up the search for sustainable technologies. This Kuznets-based argument could imply that the knowledge economy is favourable for environmental quality in the long run.

### **3.5 The emergence of the knowledge economy**

The service economy has long been considered the final stage in the pattern of development of economies. In many developed economies services now account for more than two-thirds of GDP. The new wave of technological change alluded to above provides a new impulse for the service economy. The knowledge revolution makes everything more precise, smaller, faster and cheaper. Process and product innovations are introduced in rapid succession, and new ICT, telecom and media services are marketed. The impact of this revolution is perceived in terms of the new economy that will free us from inflation and recession. Above all, it is said that the new economy will be virtual, i.e. immaterial, with environmental degradation a thing of the past. However, whether we will really move in the direction of a knowledge-intensive services economy in which our needs are largely satisfied by intangible services depends greatly on the extent to which activities with a large impact on the environment are replaced by cleaner alternatives. As things stand now, , the virtual products of the new economy are not that intangible, generate additional physical flows and are complementary to rather than substitutes for the existing product mixes that are produced and consumed. The knowledge economy may even lead to the paradoxical situation that advanced knowledge and rising incomes may generate an unprecedented rise in the demand for goods, thus exerting a devastating impact on the global environment.

### **3.6 Improvement of logistic and transport systems**

At a world-wide level we are observing an enormous improvement in logistics and transportation systems. The design of terminal facilities (e.g. for global container transport) and the development of hub-and-spokes systems have generated a huge increase in transportation productivity. This trend is of course backed by the growth in international trade as a result of globalization forces. The efficiency increase in the transportation sector and the fierce competition in the sector have led to price wars,

which encourage long-distance haulage. The leisure market for air passengers is a good illustration of this trend. Consequently, it seems likely that as a result of various mutually reinforcing trends the volume of transport will show a continual rise in the future. In as far as the transportation technology is unable to develop more environmentally-benign options, one may expect a negative impact on the global environmental quality. It should be noted that in general an increase in the efficiency of transport systems may be environmentally-friendly and hence alleviate the severity of global environmental change. The main question is of course whether this relative improvement could be overshadowed in the long run by increases in the volume of physical movements. Various studies suggest that it is plausible that the environmental strain caused by the transport sector will continue to grow (see Nijkamp et al., 1999).

### **3.7 Demographic developments and transformations**

In the past decades demographic developments have shown a steady increase. It will take at least 50 more years before the world population can be expected to stabilize. Clearly, there will be a major shift in the distribution of the world's population. Without massive migration the now developed countries will inhabit a minority of the world's population in hundred years from now. It is clear that more people will impose a greater strain on environmental sustainability in developing countries. If the technological progress in environmentally-benign products and services lags behind in relation to the growth rate of the population or their material consumption, then a major threat to the global environment can be expected.

Apart from the quantitative increase in the population, we will also observe a qualitative shift. There will be an ongoing shift towards urban modes of living, which will mean the emergence of many mega-cities with more than 10 million inhabitants. As a consequence, the quality of the local environment, including key resources such as water and food, will increasingly become a major source of concern. On the other hand, cities offer great opportunities – because of their scale and agglomeration economies – for increasing efficiency in the use of environmental and energy technology. In conclusion, demographic change in association with settlement change will be a major cause of environmental change on our planet.

### 3.8 Cultural shifts

The world economy is not only moving towards an integrated network constellation, but also towards a global culture and a new type of civil society. The openness of cultures has prompted a dissemination of views, perceptions, insights, knowledge and cultural identities, a phenomenon also instigated by the modern ICT sector. Cultural globalization, , which does not mean a uniform global culture but rather a blend of global commonalities and local specificities, seems likely to become a major new development. This has also led to the emergence of ‘glocalization’, a mix of globalization and localization.

The openness of our network society also leads to volatility in attitudes towards and perceptions of culture. Dynamic movements of cultures have become a world-wide feature. As a result, we are also observing a trend toward rapidly changing consumption patterns with a certain degree of standardization (e.g. the hamburger culture). Fashions happen in quick succession with a permanent demand for new products and designs, leading to a rapid depreciation of the existing stock of consumer goods.

The personal responsibility in an individualized society leads to responsive citizens with a sense of the civil society. Consequently, decentralization and privatization have become the features of a new type of democratic culture in which loyalty and solidarity are observed mainly from the perspective of individual welfare and local interests. Self-governance is becoming a new characteristic feature of this civil society. At the same time, however, the common nature of many resources (climate, water, e.g.) also needs a new form of international governance.

The tension between individual micro-interests and collective macro-interests also creates tensions between global standards and cultural identity at a local level. This has important consequences for the pursuit of sustainable development all over the world. Conflicts over the cross-boundary management of water resources, deforestation and fishing grounds, for instance, pose a severe threat to human security and biodiversity.

### 3.9 International business strategies

Internationally operating private companies play a crucial role in climate change as major emitters of greenhouse gases, as economic powers that cannot easily

be neglected as well as for their technological capabilities and capacities to invest in mitigation technologies. The international business community follows the climate policy negotiations with suspicion and tries to protect its interests in a climate policy-induced changing world economy. Until recently, the views of the business community were dominated by the potential losers in the event of decisive international action on climate change, led by fossil-fuel interest groups and organizations representing relatively energy-intensive industries. However, positions are slowly but steadily changing (see Oberthür and Ott, 1999; Van der Woerd et al., 2000). Business NGOs like the World Business Council for Sustainable Development now follow a more active strategy by not opposing climate policies but calling for prudent action that does not disrupt international business too seriously. For example, almost all major chemical companies monitor their greenhouse gas emissions and a growing number have set quantitative targets for the reduction of these gases, either in terms of absolute or relative emission targets. To take another example, big oil companies such as Shell and BP have adopted a more proactive stance towards climate change. They have supplemented their core business of extraction, refining and distribution of oil (products) with the development and exploitation of low-emission and renewable energy sources. Both companies also introduced in-company schemes for CO<sub>2</sub> emission trading. The automotive industry world-wide has also come to see that they must be better prepared for a world of low-emission vehicles and transport modes. Even commercial banks and insurance companies, European-domiciled financial institutions in particular, are showing a growing interest in climate change. Insurance companies have to address financial risks related to climate change and communicate on them. But the banking sector is also exploring proactive business strategies by setting internal energy targets, by developing new services, such as green mortgages for energy-efficient buildings and green investment funds, and by exploring a role for the banks if the Kyoto flexibility mechanisms become fully operational. Leaders in proactive business strategies are the potential winners with new combinations of economic activities. For instance, industries represented by the Business Council for Sustainable Energy constitute a broad technological-industrial complex, comprising research groups, engineering and consultancy firms and contractors active in the development and marketing of energy-efficient appliances and renewable energy technologies.

#### 4 Megatrends and the Need for conducive Climate Change Policies

At first glance, the megatrends identified above portray a global economy where Western patterns of energy-intensive production, modes of consumption, lifestyles and transport rapidly spread across countries. The risk is even larger if the global economy locks itself into this energy-intensive trajectory, energy demand and greenhouse gas emissions will only increase in the decades to come.

However, it is becoming equally clear that the same megatrends contain the seeds of change. It is undeniable that a shift is occurring in economic structures away from manufacturing towards services. This shift will gradually emerge in developing countries and Eastern Europe as economic development proceeds. The service economy is transforming into a knowledge economy and information society. ICT is democratic and there are indications that the knowledge economy will spread world-wide at a much faster pace than any previous technological trajectory. There is considerable technological potential for major productivity increases in food production. Breakthroughs in energy technology are not far away. These major transformations are supported by the promise that rising global welfare will lead to greater concern for the environment and the interests of future generations. This concern is already voiced by the emerging civil society and reflected in proactive business strategies. Indeed, the potential to achieve change and embark on a world-wide sustainable growth path is impressive.

But this potential still has to be realized. As things stand, by far the majority of the new technologies, new environment-efficient products and new ICT-related services either generate additional physical flows or come on top of existing goods and services. The bounds of possibility are increasing and needs are adrift. It has to be realized that technological potential will only lead to a reduction of greenhouse gas emissions if it substitutes for the energy-intensive trajectory in such a way as to outweigh the growth of world population and *per capita* income levels. This requires a profound transition, whereas the offspring of the new economy are more complementary to existing patterns of production and the ways in which people work and live.

The challenge is to create a world-wide institutional infrastructure and appropriate incentive structures to drive change rapidly and broadly enough for the potential and promise to materialize. The lack of properly functioning institutions is

one of the major impediments for an effective climate change policy. Such a world-wide institutional infrastructure would need to meet various criteria.

In the first place, it would need to be backed by sufficient reliable information; lack of information would lead to arguments and controversial policies. Second, given the complex global institutional ramifications, this type of infrastructure has to foster global co-operation, with sufficient attention for differences in economic welfare and in adjustment mechanisms among different players. Such players would not only be governments or public bodies, but also NGOs and the international private business sector. A major task of a new institutional infrastructure would be to act as a vehicle for change, with a view to the identification of creative and widely supported changes. This would not be based on a blueprint for climate change policy, but on learning principles. And finally, enforcement of change would have to be legitimate in our global democratic society.

The realization of the tasks of a new institutional infrastructure would have to be based on sound economic principles that would offer a proper incentive mechanism. This implies, among other things, incorporation of global environmental costs in our current modes of production and consumption. Furthermore, such a scheme would also have to make it attractive for public, private and semi-private bodies to join such a global 'club', as there may be many positive externalities of both a tangible and intangible nature involved, also in the short run. These potential benefits include the creation of a new competitive strength in energy-efficient technologies and renewable energy sources, improved energy infrastructures and greater security and safety of energy supplies, secondary benefits of improved local air quality, renewables-based electrification of rural areas, symbiosis between sinks and biodiversity, more effective transfer of technology, capacity-building and financial and technological assistance for global environmental policies. The rules governing such a mechanism (the instruments, the flexibility mechanisms) would have to be established in parallel to the formulation of global targets on environmental change. In this respect, the Kyoto and post-Kyoto negotiating process has not been very productive. In Kyoto, emission reduction targets per country (group) were negotiated, while the working and scope of the flexibility mechanisms were left largely undecided. This led to stagnation in the process of implementation. It is inevitable that when reduction targets are fixed and binding and the mechanisms are still under negotiation, countries will try to stretch these mechanisms so as to reduce

their national compliance cost. In fact, what we have seen in the post-Kyoto negotiating process is the trading off of flexibility mechanisms (including sinks) against reduction targets. This detracts from the credibility of the Kyoto Protocol and limits the potential benefits from materializing. The coming years must be used to define the flexibility mechanisms in a credible and verifiable way and to put them to work. Practical experience is needed to further improve and elaborate these mechanisms, and to try to foster and integrate the seeds of change contained in the megatrends. Clearly, a combination of research, institutional learning and creativity is essential in developing such a new international framework for governing climate change.

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