

Responding to the Asian Challenge

Science is key, engineers are the locksmith

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Ministers, Excellences, Ladies and Gentlemen

[Yes, Asia is on the rise but do we really see what is happening?](#)

Growth rates in China no longer capture the headlines in amazement. China's astonishing economic performance seems to have stopped to awe European policymakers. Comments focus on the sustainability of China's growth, the viability of its financial system and China's exchange rate policy. China is now a recurring item in the regular business of our financial and monetary authorities.

However, this primarily macro-economic approach blinds us for the more fundamental shifts caused by developments in Asia, China in particular. Major change is already now well underway and it will fundamentally affect the geographical focus of businesses, technology and science. In fact, globalization, though as a word already with us for quite some time, has only just started to spread its full impact.

The dynamics of change are increasingly evident. Eight of the ten global companies with the largest R&D budgets have established R&D facilities in China, India or both. In a survey of global firms planning to build new R&D facilities, 77 percent say they will build in China or India. So international business amply exploits its capacity to operate footloose. Businesses opening up shops in different parts of the world are not a new phenomenon per se. But the current scale is, as well as the inclusion of R&D-activities in this. Much lower costs of operations abroad are no longer the sole motivation. Excellent facilities and the supply of talented researchers are now more often cited as the main driver to build R&D facilities in China, India or Singapore.

So corporate investment travels worldwide and in Asia in particular, seeking to exploit regional comparative advantages to the max. The crux of the matter is that in its wake science and technology travel as well, seeking to profit from the same kind of comparative advantages, especially in Asia. In fact one could argue that science and technology are even more footloose and globalized than the business sector is. The establishment of mirror- or satellite campuses of mainly US universities overseas is now complementing what is already there in the form of numerous global networks of researchers in all sorts of scientific fields. And policymakers in Beijing, Seoul, Hanoi, Singapore are actively responding to this mobility of business, R&D, technology and science.

If the locus of science and technology shifts decisively eastwards, and Europe does nothing about it, the continent's real strength in the international corporate sector will also be fatally undercut within a generation or so. We will become even more dependent on the new poles of scientific and economic growth in Asia and elsewhere in the world. The link between science and the future vitality of our international corporate sector is thus key too.

[For Europe, science, technology and innovation are the only trump cards](#)

Let me dwell for a moment on this issue of comparative advantages. If the scope for geographical location is widening, the world will turn into a more fiercely competitive place. In economics, traditional long-term models explain growth by demographic developments, the availability of arable land, the presence of fossil fuels and raw materials. And of course economists have added advancements in science and technology to the explanation of long-term growth.

This is all pretty straight forward, but as a consequence the relative scores of regions on these fundamental key drivers of long-term growth explain inter-regional growth patterns. This slide shows that Europe has a relatively poor performance on the more traditional growth drivers, meaning Europe is in disadvantage. However, when we turn to science and technology Europe's picture turns rosier.

The message is as clear cut as simple: science, technology and innovation are the only comparative advantages Europe can bring to bear in order to secure its share of the world's future growth. The warning is as clear cut as simple as well: Europe's comparative advantage in science and technology is not a given, since we live in dynamic times.

[China's progress: the dawn of a new world order in science and technology](#)

The current dynamics are largely due to the rapid progress in China. China's pursuit for economic growth is easily explained by the rapid ageing of the population. It is urgent to raise per capita income levels within 20 years enabling the Chinese to take care of their parents and grand parents. As a result of China's one child policy this can be quite a crowd for one working couple. The irony is that China as one of the oldest surviving civilizations, finds itself in a hurry.

The implication is that growth in quantitative terms is simply not enough. For China it is crucial to move up simultaneously in the product value chain. In China the production cost of an iPad is 40 euro's, while the consumer in the US or Europe pays 600-800 euro's. For the Chinese, the arithmetic is simple, China should and could benefit from a larger share of these margins. For that reason China wants to be in the forefront of consumer goods, other end products, machinery, equipment, information technology.

In the past decade China has doubled its R&D to GDP ratio to 1.5 percent today. For 2020 the Chinese leadership has set 2.5 percent as a target. The number of higher education institutions rose from 1.022 to 2.263 and the number of students enrolled in degree courses increased from one million to over 5 million. The investment in research facilities is impressive and in some cases even ahead of the hiring rate of dedicated researchers to populate them.

The strategy is clear, if you want to control the value chain of production, you have to be a leader in science and technology. The Chinese leaders have not made a secret of their ambitions, as China's prime minister Wen Jibao stated the following: "The history of modernization is in essence a history of scientific and technological progress. Scientific discovery and technological innovations have brought about new civilizations, modern industries, and the rise and fall of nations ... I firmly believe that science is the ultimate revolution".

China's policies have not been without initial results. In less than 15 years, China has moved from 14th place to second place in published research articles (behind the United States). Admittedly, China's overall scientific position right now is sometimes exaggerated. Concerns rightly persist about (i) whether its educational system sufficiently encourages creative thinking, (ii) lack of comprehensive systems thinking and (iii) the ability of the Chinese corporate sector to absorb so much research. So the exact scale of China's achievements is difficult to predict. It is undeniable however that we are witnessing the dawn of a new science and technology world order.

[Europe will have to act on innovation](#)

European scientific dominance being challenged, the question arises how to maintain or enhance the future standard of living of the European citizens. The answer is through innovation, the art of turning leading edge research into marketable sought-after products and services, through world-class engineering and through extraordinary entrepreneurship.

This requires diligently designed management of education, science and technology. Lacking such a policy will result in disaster, as the United States Commission on National Security for the 21st Century has so succinctly put in their report: "Second only to a weapon of mass destruction detonating in an American city, we can think of nothing more dangerous than a failure to manage properly science, technology and education for the common good..." One cannot deny our American friends a certain propensity for drama, but this time I am inclined to agree.

[Role of engineering sciences in science and innovation](#)

As president of Delft University of Technology, I will hopefully be forgiven to dwell shortly on the nature of engineering and its importance in science and innovation. Probably on the grounds of its simplicity, policymakers tend to hold on to the "linear model" of innovation in which science is differentiated in basic and applied sciences. The model states that in a linear sequence basic science leads through applied research and engineering to technological application and innovation.

Many, and I am one of them, regard the "linear model" as descriptively inaccurate and as doing injustice to the width and depth of engineering sciences. I show you this diagram to illustrate my point. Through the observation of phenomena and the development of hypotheses, experimentation and theory engineering produces knowledge upon which predictions or applications may be based. By doing that engineering is as much part of science as is fundamental astrophysics. It is only through a deep understanding of science that an engineer can do his/her work in protracting science into

the realm of application. That is why engineering is so central in bringing innovation about, in connecting needs of society and nature to science and the relevant tools. Once again, I will hopefully be forgiven to place the work of the universities of technology in Delft, Eindhoven en Twente right in the heart of this all.

In the western world the valuation of engineering sciences seems to have been eroded, while in the more vibrant economies in Asia, the BRIC countries in general, engineering sciences are cherished and judged crucial for success in innovation and in addressing urgent societal challenges. For example, China is a society not just where engineering is valued, but that is also governed by engineers and people with engineering mindsets; quite different from Europe and the Netherlands in fact. It is urgent for our governments to develop policies to turn this trend, to demonstrate their full commitment to the engineering sciences, to be more mindful of balanced skill compositions in the relevant government bodies and to encourage our youth to consider a career in engineering.

[The critical success factors in innovation](#)

For innovation to be successful a report prepared for the presidents of the three National Academies in the US points at three crucial primary ingredients for successful innovation: 1) new knowledge, 2) capable people and 3) an environment that promotes innovation and entrepreneurship.

[1\) New knowledge](#)

New knowledge is essential for innovation, since the innovation system needs to be fed with new ideas and insights. However the creation of knowledge through fundamental science is not a command and control phenomenon. The outcomes of fundamental science are long term, impossible to direct and of uncertain applicability. Serendipity is a beautiful thing. On top of that fundamental science is increasingly expensive. In fact scientific activity unfortunately represents everything our western governance culture, submerged in efficiency and accountability criteria, resents. My response to that is: too bad, if you want new knowledge to be created, you have to adopt long leash policies; have faith in your scientists and researchers.

There are at least four important trends in how research is done, that policymakers should thoroughly understand.

- Do not expect the corporate sector to step up the plate of financing long term basic research; the timeline is simply too long and the uncertainties too high for most companies to fit well in their strategies. The 2008 crisis has exacerbated this point.
- Appreciate the truly globalized nature of scientific work. Researchers are increasingly members of huge global networks, often in a multidisciplinary context. This inevitably implies that research is no longer confined to the national domain.
- Understand the crucial importance of top class lab facilities and research infrastructure. Science and top-researchers are ultimately foot loose and will go there, where the conditions for their research are best.
- Allow top research universities to run their business as they see fit, implying student admission, the level of fees, investments in a presence on other campuses of top universities in the world etc. in order to allow

them to be fully flexible in the international positioning that has been started and will be in full progress in the coming decade.

2) Capable people

A recent Goldman Sachs report (September 2010) on "The new geography of global innovation" highlights the crucial importance of higher education in the science and engineering fields for the new geography of global innovation. Since in our part of the world student interest for science and engineering sciences has been low, we will face increasing difficulties to replace aging cohorts of native-born scientists and engineers. The report therefore predicts an increased reliance on foreign-born skilled labor. Immigration policies should be further geared to be more flexible and talent friendly in order to attract and retain foreign talent in the area of science and engineering. And of course policies to encourage young people to opt for a professional future in engineering and science should be energetically pursued.

3) Environment to promote innovation and entrepreneurship

There is a whole range of issues here of a very different nature. The newly created ministry of Economic Affairs, Agriculture and Innovation in the Netherlands is well advised to thoroughly assess these issues on their impact on the innovation climate. I will not go through this list now, but I am sure that entrepreneurs present here today will have something to say on the various topics on this list. I for myself would only like to reiterate here the proposals of the three Universities of Technology in the Netherlands to muster even closer ties with the research institutes in the Netherlands.

International cooperation

The art of living through transition times is basically the art of leaving behind the old and embracing the new. We, in the western world are not particularly good at that. Our missionary, 19th century spirit stands in the way, but, alas, our days of quasi almost rule of the world are over. A recently issued AstraZeneca survey indicates the increased confidence both within China / Asia, and indeed across the world, that China will be number one in innovation by 2020. I think there has been a marked shift in public opinion at both the popular and elite level since the 2008 financial crisis on this. This sentiment can become a self-fulfilling prophecy driving even more research and investment eastwards. We also know how important the financial crisis has been in strengthening the Chinese elites sense of confidence in their wisdom of their own growth strategy vis-a-vis the West. In that sense, 2008 has been a crucial tipping point and - looked back in history in decades to come - might be seen as the moment when the era of Western dominance subsided.

This is not to imply that the western world is doomed to fade into irrelevance. On the contrary with the rise of the Asian economies new opportunities arise as well. And we are particularly well placed to fully tap into the success of our Asian friends. The quality of science in our part of the world still ranks best and our corporate sector successfully operates on a worldwide scale. We can and have to engage into a wide cooperation in all possible fields with the Asian continent.

In a recent article in the Wall Street Journal I argued that in fact the window of opportunity to develop that kind of cooperation lies within the coming ten years. It is no exaggeration to echo the words of Maire Geoghegan-Quinn, European commissioner for research and innovation, that Europe is facing an innovation emergency.

It will require huge financial investments to keep our research and innovation system up to par for us to play that game. But the rewards are huge too. In the coming ten years cooperation will allow us to embrace the major players in Asia, China and India into a system of business practices that have brought us so much prosperity. I believe that the adoption of principles like for example on free trade and open innovation will be of great mutual benefit. I am not sure whether in ten years from now this opportunity will still be the same. The Chinese innovation system might have turned into a juggernaut, supported by a gigantic domestic market, dictating norms and standards that we have to accept on the mere argument of size.

History teaches that transition times provide opportunities for visionary leadership. My advise would be: be confident on our strong poll position in the global race, focus on and invest in science and technology, embrace your engineers, and create the environment to make innovation happen. This is a recipe for a prosperous Europe that can meet the challenges of our common future.

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