Rabobank

The Rabo Innovation Index

How can the Netherlands boost its innovation capability?

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Economic Research Department

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Summary

Innovation is today's equivalent of the Holy Grail. Governments in the advanced countries see it as a way of keeping up economic growth amid deteriorating demographic prospects. Emerging countries see it as a way of catching up with the industrialised countries. And firms everywhere see it as the key to survival given the cut-throat competition in our globalised world. Sadly, not all countries are equally successful in spurring innovation. In specific, the Netherlands is not particularly innovative when compared to the major economies according to our recently constructed Rabo Innovation Index (RII). In spite of the government policy, private investments in knowledge, research and innovation in the Netherlands have not kept up with GDP growth in recent years and have been lagging behind investments in some advanced economies.

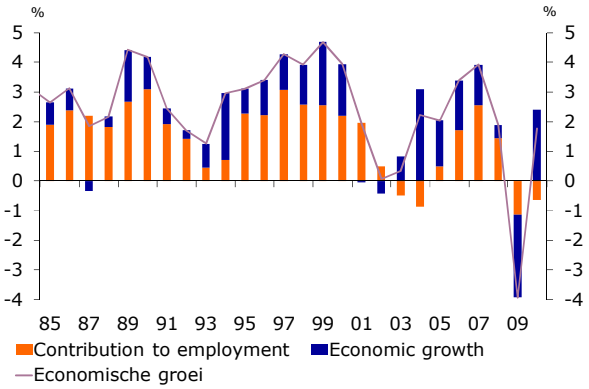
The good news is that a number of appropriate policy measures can bolster innovation going forward. Firstly, if the Netherlands aims to be one of the top five knowledge economies, the basic quality of higher education needs to be improved and private-public collaboration should be further encouraged. What's more, interdepartmental coordination and cohesion in policy design needs to be improved as well as streamling the number of instruments in the innovation governance system. After all, (implementation of) innovation policy is not free of charge. Finally, throwing massive sums of public money does not necessarily lead to a succesfull innovation policy. Improving framework conditions could prove in the long run to be more beneficial to spurring innovation activity.

Why innovate?

Innovation is the key to prosperity

Innovation has become the new buzzword in the industrialised world as politicians look for ways to prop up their economies amid the sluggish post-crisis recovery and the poor demographic prospects. Also the Netherlands is vulnerable given its ageing labour force. During the late 20th century, the labour force in the Netherlands grew rapidly as the postwar baby-boom generation came of age and labour force participation rose. As a result, labour force growth accounted for roughly 70% of total GDP growth in the period 1985-2000. But as baby boomers retire and the participation rate plateaus, the Dutch economy will receive significantly less lift from increases in the labour force. According to the European Commission, the working age population (as a share of total population) of the Netherlands will decrease from 67.2% in 2010 to 57.8% in 2060. This demographic shift means the Netherlands will have to rely increasingly on productivity gains through innovation to fuel growth in the coming decades.

Figure 1: GDP growth breakdown



Source: Reuters EcoWin, NIESR, Rabobank

What is innovation…

But how can one boost innovation without knowing exactly what it means? To many, innovation is simply the development of new technology. Yet according to the Oslo Manual (2005) innovation is a much broader concept and it is no longer restricted to research and development (R&D) laboratories. Based on the definition of the Manual "*an innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations*".

In spite of the apparent clarity of this broad definition, measuring innovation in a form that is useful for policy purposes has proved particularly challenging. The central problem is that no two innovations are alike. Some innovations (e.g., the invention of the telephone or the personal computer) create a whole new market sector whereas others are useful but trivial (e.g. the upgrade of iPad1 to iPad2). Capturing innovation confronts statistical challenges as well. For one, direct official measures that would quantify innovation outputs are frequently not available across many countries. This is particularly true if one considers our broadening notion of innovation. What's more, there isn't also a clear understanding of which factors interact in specific country settings. Many factors may not operate in an identical manner across different countries.

Why innovate?

All these challenges notwithstanding, we believe it is still useful to measure innovation in order to enable policymakers to benchmark their policies with the other major economies. To this end, we have constructed a composite indicator, which we have christened RII –the Rabo Innovation Index (RII)– to establish an 'objective' framework for measuring innovation. More specifically, we wish to rank the major economies from most to least innovative based on a number of subjectively selected indicators. This will allow us to see how well/poorly the Netherlands performs compared to the other major advanced and emerging countries[1].

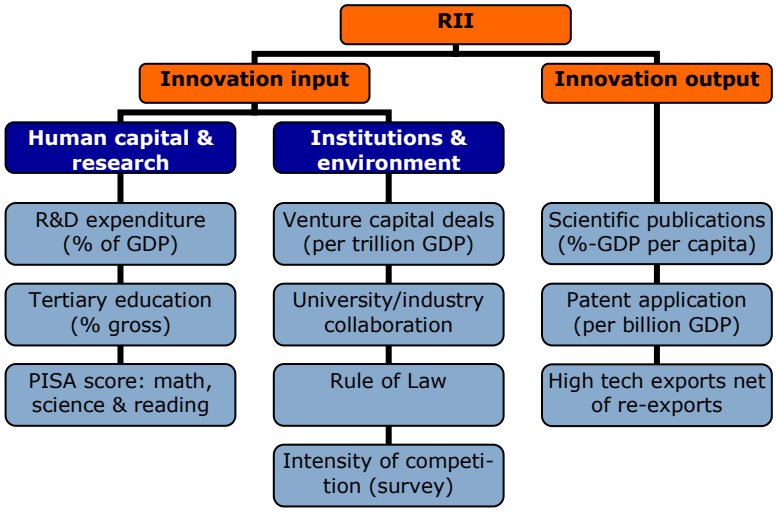
Note that other institutions have also produced innovation indices (e.g. the INSEAD business school, the Boston Consulting Group, and the Economist Intelligence Unit). There are three reasons why we still decided to create our own innovation index. First, the available indices are constructed based on so many variables that essentially makes the analysis cumbersome. It is difficult to make policy recommendations if a country performs relatively poor on, say, 50 indicators. What's more, many of the included variables in these indices are highly correlated with one another, which means their added value to the broader index is close to zero. Second, the researches done by many of the institutions are on an *ad hoc* basis. Our own index provides us a quick tool to measure the progress of a given country over time. Third, we believe there is merit in using the most recent data available for drawing policy conclusions.

Before discussing the methodology and the results, it would be important to stress that that this exercise is by no means flawless. Combining various metrics into a simple measure of innovation for an economy is fraught with statistical and other complexities, especially when considering economies that are often vastly different in size, population, and stage of economic development. Moreover, by selecting a set of indicators and excluding others, some information may be lost. Finally, the absence of a strong theoretical base regarding the weights of each indicator forces us to give equal weighting to each indicator. This might be too simplistic given that some variables are perhaps more important when it comes to assessing a country's innovative capacity. That said, the RII can help us summarise abundant information in an objective manner and, for this reason, is deemed as a useful, albeit imperfect, tool for measuring innovation.

[1] For ease of analysis, we included the major European countries plus the US, Japan and the BRICs (Brazil, Russia, India and China).

Introducing the indicators

After looking at a host of variables, we settled on ten indicators taken from a variety of sources that we believe can roughly measure a country's innovation capacity[2] (for the statistic and qualitative description please refer to the appendix). A trade-off between precision and country coverage was often made in selecting the indicators to be included in the RII model. The RII relies on two sub-indices (see figure below), the innovation input sub-index and the innovation output sub-index. As regards the former, two pillars capture elements of the national economy that enable innovative activities: (1) human capital and research and (2) institutions and environment. The first pillar is the level and standard of education and research activity in a country, which are the prime determinants of the innovation capacity of a nation. As for the second pillar, nurturing an institutional framework that attracts business by providing good governance and the correct levels of protection and incentives is essential to innovation. The business and political environment are also of utmost importance to attract innovative firms and a high skilled workforce. The output pillar captures actual evidence of innovation outputs. It includes three indicators that are the result of inventive and innovation activities.



Once the variables are selected, given all their known constraints, we construct a z-score in order to be able to interpret the countries' relative positions. Note that the greater a country's z-score, the more innovative it is considered to be. To benchmark our RII rankings, we have compared it with the rankings provided by the INSEAD business school, the Boston Consulting Group (BCG) and the Economist Intelligence Unit (EIU).

[2] UNESCO, OECD, Thomson Reuters, World Bank, World Economic Forum.

RII: Our main findings

When glancing through the table, a number of interesting observations catch the eye. The most noteworthy observation is that Scandinavian countries (excluding Norway) dominate the top 5 positions in the RII. Also of note is the relatively high ranks of the US and Switzerland in the RII as well as in the benchmark indices. On the other side of the spectrum, the Southern European countries (Spain, Portugal, Italy and Greece), which are currently grappling with a debt crisis, are the least innovative advanced countries in our sample pool. This is again very much in agreement with the rankings provided by the benchmark indices. Ireland is the only crisis-hit periphery country that has a relatively strong innovation capability (we have extensively discussed this in the past – see our Economic Quarterly Update 09/2010, Ireland: a strong economy falters). From the BRICs, only China manages to outperform the major advanced economies in our sample by scoring higher than the Southern European countries[3]. Unsurprisingly, Brazil and Russia are in the bottom of the table.

Rabo Innovation Index (RII)

	Ranking based on:			
	RII	INSEAD	BCG*	EIU**
Sweden	1	2	6	5
Finland	2	3	3	3
Switzerland	3	1	1	2
United States	4	5	4	4
Denmark	5	4	7	8
United Kingdom	6	7	9	13
Germany	7	8	12	6
Japan	8	12	5	1
Netherlands	9	6	8	7
Ireland	10	9	2	14
Belgium	11	14	15	11
Norway	12	10	11	12
France	13	13	13	10
Austria	14	11	10	9
China	15	15	16	21
Spain	16	16	14	16
Portugal	17	17	17	18
Italy	18	18	18	15
Greece	19	22	19	17
India	20	21	20	22
Russia	21	20	21	19
Brazil	22	19	22	20

* Boston Consulting Group

** Economist Intelligence Unit

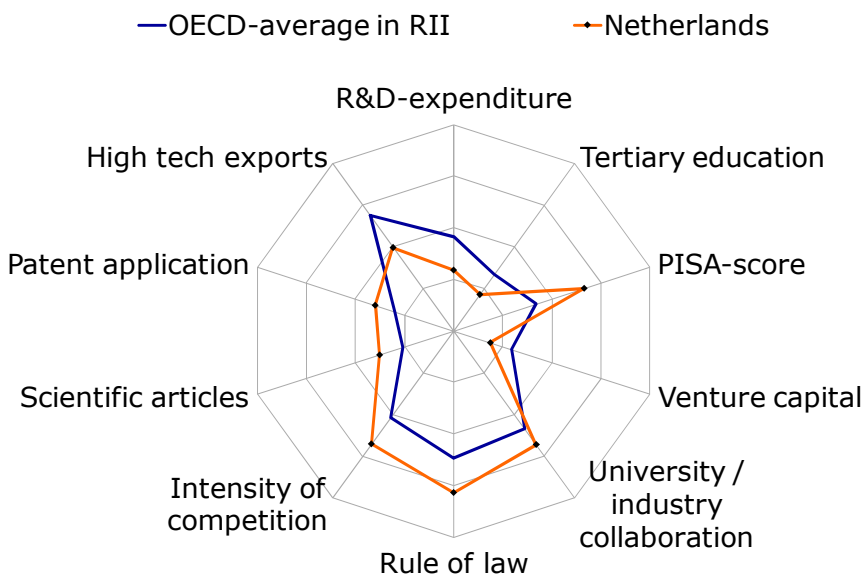
[3] For more on the innovation performance of China and India, see Rabobank Special 11/06.

RII: Dutch innovation performance

As for the Netherlands, the country comes in 9th in the overall RII ranking. This is a touch below the rankings given by the benchmark indices. Although the country does not top any individual indicator, it places within the top 5 in three indicators (PISA scores at 4th, rule of law and patent applications at 5th). The good score in knowledge creation in terms of patent applications is partly explained by strong innovation in few large multinationals in the Netherlands. Where the country performs rather poorly is the relatively low R&D intensity (12th), which has dropped substantially since the early 1990s. Private expenditure on R&D fell from 1.1% of GDP in 1990 to 0.9% GDP in 2009.[4] Government-financed R&D has been more or less stable over the same period, at 0.9% of GDP, resulting in total R&D spending of 1.8% of GDP in 2009. This figure is far below the OECD average of 2.3% of GDP and is still some way off the government's ambition to achieve R&D intensity equal to 2.5% of GDP in 2020. The OECD (2006) argues that 60% of the shortfall in the private R&D intensity to the OECD average is linked to the sector structure in the Netherlands. The economy includes a relatively large services sector with low level of innovation, while high-technology sectors represent a limited part within the already small industrial sector. Hence, the number of innovative SMEs in the Netherlands is

Dutch innovation performance in international perspective

(Closer to the centre suggests lower performance)



Source: Rabobank

[4] The current financial crisis may cause companies to reduce their R&D spending and reinforce the trend of shifting R&D activities from the private sector to the public sector, such as expension of public-private collaborations (EC, 2009 and 2011).

relatively low (24% of all companies in 2008) and there is a high concentration of R&D activities in a limited number of large multinationals. The remaining 40% can be explained by a number factors, including the relatively low R&D intensity of foreign direct investment, concentrated mainly in headquarters, distribution, marketing and sales (Erken and Ruiter, 2005). According to our RII the other main weakness of the Dutch innovation system is the low tertiary school enrolment (11th). During the last two decades, the proportion of people who had attained tertiary education has increased by roughly 10%-point to around 33%. This is slightly above the OECD average (30%) but ranks 13th amongst the high-income countries. The CPB (2009) concludes that the early tracking regime[5] in the Netherlands negatively effects participation in higher education. Also, the Dutch learning culture is often defined as not ambitious enough, failing to motivate and challenge students (EC, 2009).

As for venture capital deals (10th), in 2000 the Netherlands ranked among the countries with the highest level of venture capital investment as a percentage of GDP. However, venture capital investments have been decreasing ever since. Both the dotcom crash and the recent financial crisis resulted in a considerable decline of new venture capital funds being established in the country. This has been particulary true for early-stage venture capital. Besides, there is still no integrated European venture capital market, making cross-border investments costly and time-consuming.

Finally, the Netherlands scores relatively poorly on university/industry collaboration (9th).[6] In 2008, 36% of innovative Dutch industrial companies were involved in public and/or private collaboration. This may point to the fact that universities are incapable of commercialising their research and do not have enough incentives to exploit their knowledge and patents. Strong public sector interference with the research market may lead to research in certain, predefined areas, which could crowd out public-private collaboration (OECD, 2006).

Innovation policy in the Netherlands

In view of a rapidly changing economic and demographic situation, the above-mentioned weaknesses in terms of innovation may pose a threat to long-term growth and the country's future competitive position. The key challenges for the Netherlands are to (1) increase the R&D intensity and the number of innovative SMEs, (2) attract foreign investments in R&D and (3) create an excellent learning and research climate. The Netherlands aspires to be one of the top five knowledge economies worldwide in 2020 (Innovatieplatform, 2010).

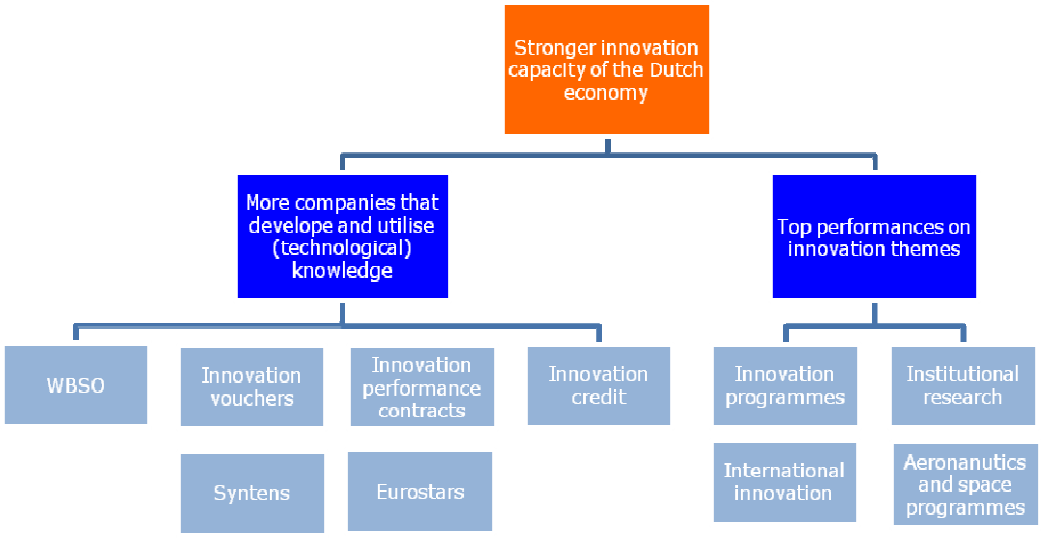
[5] In the Netherlands, students are placed under different education systems (VMBO, HAVO and VWO) based on their capabilities (partly measured by CITO scores) after finishing primary school (around the age of 12).

[6] However, the Netherlands scores above the average of OECD countries observed in the RII.

The Dutch performance

The main reason for public investment in R&D and innovation is market failure. It is argued that the private sector may underinvest in R&D projects because the private gains from R&D investment are lower than the total social gains due to the spillover benefits from one business's investment to the productivity of other businesses. Private gains are estimated to be between 7% and 14%, while social gains are generally higher yet more uncertian and vary between 4% and 184% (CPB, 2011).

Dutch innovation policy



Source: Ministry of Economic Affairs, Agriculture and Innovation Budget 2011

The Ministry of Economic Affairs, Agriculture and Innovation (EL&I) and the Ministry of Education, Culture and Science (OCW) play a key role in establishing broad innovation policy in the Netherlands. On the one side, OCW is responsible for scientific research and education. In 2008 the total government expenditure on education and research amounted to 5.6% of GDP, below the OECD average of 6.1% of GDP[7] while spending on *higher* education and research amounted to only 1.3% of GDP. The latter is expected to decrease during the current cabinet period (OCW Budget 2011). On the other side, EL&I is responsible for industry-oriented R&D and innovation policy. The policy mix consists of two packages, a generic basic package and a specific programmatic package (see figure above).

[7] This proportion exceeds 7% of GDP in Iceland, South Korea, Norway, United States and Denmark, while Polish and Estonian public spending on education (5.8% of GDP) are higher than those of the Netherlands.

The basic package for innovation is accessible to all entrepreneurs and it comprises instruments, such as R&D tax credit[8] and innovation vouchers, aiming at fostering R&D by alleviating the wage burden for companies through tax reduction and encouraging interaction between SMEs and research institutions. The focus of the programmatic package is mainly on innovation programmes, which give strategic sectors of the Dutch economy (e.g. food and nutrition, chemicals, life sciences and health) the possibility to develop broad and custom made innovation programmes. In 2010, the basic package received € 886 mln and the programmatic package € 634 mln. During the current cabinet period the total budget for innovation policy mix is expected to decrease to € 1.1 bn in 2015 (EL&I Budget 2011).

Innovation policy: some remarks

According to recent studies it remains difficult to assess the economic impact of the innovation policy. For example, the Court of Audit (2011) could not determine whether the doubling of public expenditure on innovation policy from € 1.8 bn in 2003 to € 3.7 bn in 2010 had boosted the innovation in the Netherlands. Specific measures can help address innovation challenges but the overall impact of (fiscal) policy measures appears to be small (OECD 2005, CPB 2005). Moreover, the question arises why the current government is planning to invest up to € 1.5 bn up until 2015 in the strategic sectors that already have an internationally strong position, running the risk of funding investments that would be made anyway. Although, the impact of innovation policies on economic indicators takes time, private investments in knowledge, research and innovation in the Netherlands have not kept up with the GDP growth in the recent years and have been lagging behind the investments in other advanced economies. This indicates that there is room for improvement of the current government policy.

If the Netherlands aims to be one of the top five knowledge economies then the basic quality of tertiary education and the proportion of the population with tertiary education need to be increased. This will require not only an efficient deployment of the exisiting funds, but also extra investment in education and research going forward. Funding of higher education should focus on performance and quality of programmes and greater priority should also be given to the availability and quality of the teaching staff. More freedom in setting tuition fees and more competitive environment for public funds should enhance the quality of courses offered and provide universities with an incentive to develop more tailor-made programmes, from which both students and the labour market would benefit. Studies show that stimulating more mixed-level education in the first phase of secondary education by postponing the age at which children are placed in different education streams could increase tertiary school enrollment and completion (CPB, 2009). Another overriding objective of Dutch innovation

[8] Wet Bevordering Speur- en Ontwikkelingswerk (WBSO).

policy is to improve the cooperation between companies and public research organisations, especially universities. One way to foster private-public collaboration is by making university funding partly dependent on performance in diffusion of knowledge to firms. In the past, considerable investments in R&D and education have been made via investment impulses from the Fund for the Enhancement of the Economic Structure (FES), which was supported by gas revenues. The decision-making process for the allocation of FES investments has not been sufficiently transparent. What is more important is that the exhaustibility and volatility of gas revenues result in volatile domestic spending on R&D and education, while these long term investments require more structural funding. The current cabinet has decided to no longer use the FES funds for research and innovation. Accordingly, the overall R&D budget will decease by circa € 1.7 bn in total until 2020 (KIA, 2011).

There is also a need for better interdepartmental coordination to come to an integrated approach in policy design in the field of education, research and innovation. An example of improving coordination between ministries EL&I and OCW is the jointly designed Knowledge Workers scheme, a temporary crisis measure giving companies the opportunity to second their researchers to a public research institute. The investments from the FES funds resulted in numerous temporary organisations that manage public-private partnerships in innovation. It is not clear how the individual fiscal instruments and arragements contribute to the overall innovation policy and the country's innovate strength. The government should concentrate on reducing and streamlining the number of organisations and instruments in the innovation governance system. After all, (implementation of) innovation policy is not free of charge.

To put if briefly, throwing massive sums of public money to raise the Dutch innovative capacity is neither enough nor desirable. For innovation policy to be successful, improving framework conditions could prove to be more beneficial in the long run. Easing product and labour market regulations, better capital accessing, lowering administrative burdens and the cost of doing business could make an important contribution to spurring innovation activity.

Appendix

1. Gross expenditure on R&D (% of GDP) | 2008

The total domestic expenditure on R&D in a given country generally reflects a government's or organisation's willingness to forgo current returns to improve future performance. But it is by itself an incomplete measure of innovation input as there are several non-R&D kinds of innovative expenditure. These include the later phases of development and testing that are not incorporated in R&D, capital expenditures related to the introduction of new processes, marketing expenses related to new products, certain kinds of employee training, expenditures on design and technical specifications, etc. (Hall, 2011).

2. Tertiary school enrolment (% gross) | 2008

This variable is the ratio of total tertiary enrolment to the population. Undoubtedly, higher education is crucial for economies to move up the value chain beyond simple production processes and products. The limitation of this indicator is that it does not accurately capture the quality of tertiary education.

3. The Programme for International Student Assessment (PISA) scales | 2009

The OECD PISA develops three-yearly surveys that examine 15-year-old students' performance in reading, mathematics and science. This assessment serves as a rough proxy for the quality of education in 65 participating countries. The drawback of this variable is that it says nothing about the quality of education at the tertiary level, which, arguably, matters more for innovation.

4. Venture capital deals (per trillion GDP, 2005 PPP$) | 2010

Venture capital (VC) is financial capital provided to early-stage, high-potential, high risk, growth startup companies. Venture capitalists make money by owning equity in the companies they invest in, which usually have a novel technology or business model. This makes them especially important in fostering innovation in a given country. The limitation of this indicator is its narrow scope as VC deals are mostly concentrated in high-tech industries such as biotech, life sciences, information technology (IT), etc.

5. University/industry collaboration on R&D | 2010

This indicator from the World Economic Forum is very relevant since the collaboration of firms with universities carrying out top-notch research gives them an edge over their competitors. Equally, universtities in touch with various industries can customise their research projects in a more practical way that better serves the needs of the society.

6. The rule of law index | 2009

The extent to which the rule of law prevails (in aspects such as contract enforcement, property rights, the police, and the courts) is arguably, though broad, an important precondition for firms to innovate. For example, firms have less

inclination to spend on R&D if they are unsure that (intellectual) property rights are protected or corruption is rampant.

7. Intensity of local competition | 2010

Research shows that there is strong correlation between intensity of competition and labour productivity. The reason is simple: the more firms have to compete with one another for market share, the more likely they are to innovate in order to stay ahead of competition.

8. Scientific and technical journal articles / GDP per capita, (PPP$) | 2009

The number of scientific and engineering articles published in peer-reviewed journals, collected by the World Bank, serve as a proxy for the success of a country's innovative capacity. Of course, not all publications lead to innovation.

9. Published patents at the Patent Cooperation Treaty (% of total) | 2010

Patent counts are a measure of invention success, and can be considered at least a partial measure of innovation output. The patents filed under the WIPO administered Patent Cooperation Treaty (PCT) are normally considered to be most economically valuable (as opposed to patents filed under the national patent office) since these are the innovations that inventors are likely to protect abroad. The drawbacks of patents as innovation indicators are well-known. Many innovations are not patented, and some are covered by multiple patents; many patents have no economic value, and others have very high value.

10. High-tech exports net of re-exports (% of total exports net of re-exports) | 2009

Arguably, the higher high-tech exports net of re-exports a country has, the more productive its manufacturing firms are. But once again the drawback of this indicator is its narrow focus on technology goods. In other words, the services sector is completely ignored.

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Colophon

The Special is a publication of the Economic Research Department (ERD) of Rabobank Nederland. The view presented in this publication has been based on data from sources we consider to be reliable. Among others, these include EcoWin, NIESR, OECD, and IMF.

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