Adapt or Die: The Innovation Imperative

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The following article is compiled from two research papers published by the *Economist Intelligence Unit* of *The Economist*, titled: **Innovation: Transforming the way business creates** (2007) and **A new ranking of the world's most innovative countries** (2009)

1. Introduction

Innovation has become the defining challenge for business everywhere. A decade ago, companies saw survival and growth in terms of restructuring, lowering costs and raising the quality of their goods and services. Since then, commoditisation, privatisation and deregulation have swept the world—from the advanced economies of the United States, Japan and Europe to the rapidly emerging markets of the Asia-Pacific rim and Latin America. Thanks to the internet, air travel and improved patenting procedures, access to the latest technology has become universal. Today, few firms anywhere can feel secure behind their established brands, long-standing customer relationships, proprietary technology, or tariff barriers. The competitive pressure on them is global and immediate.

Business leaders in companies big and small, in every industry, have started to refocus on top- and bottom-line growth. And the general consensus is that one of the best ways to achieve this is through innovation. The overwhelming reaction of consumers to such products as the iPod and the BlackBerry suggests that companies can grow faster if they innovate. This gives them a head start, if not an unassailable lead.

2. The Competitive Edge

Companies everywhere, especially those in advanced nations with high labour costs, have become painfully aware that even in their new slimmed-down, outsourced, globalised guise, they cannot conduct business as before. No matter how good their quality, standard products made in the standard way cannot sustain a firm's competitive edge.

Over the years a large number of studies have found a positive relationship between research and development (R&D) and growth in companies and national output. Typically, studies of the effectiveness of firm-level R&D use productivity to measure performance rather than profits. Moreover, it has been difficult to establish a direct link between innovation, or R&D, and profits, in part because the variety of influences that affect profits may be greater than for productivity.

Results that emerge from most of these firm-focussed studies include: process R&D is more beneficial for companies than product R&D; basic R&D typically yields more than applied R&D; and R&D returns vary considerably between industries, with the highest returns occurring in research-intensive industries.

Table 1: Example of OECD countries' investment in R&D as a percentage of GDP

R&D as % of GDP: Sweden tops list of OECD countries

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Sweden	–	3.605	–	4.169	–	3.848	3.624	3.795	3.741	3.634
Finland	2.864	3.16	3.344	3.302	3.355	3.43	3.448	3.479	3.449	3.473
Japan	3.005	3.021	3.043	3.123	3.165	3.199	3.167	3.323	3.394	–
South Korea	2.342	2.252	2.393	2.59	2.532	2.631	2.847	2.98	3.225	–
US	2.61	2.664	2.746	2.761	2.66	2.656	2.587	2.619	2.658	2.684
Germany	2.272	2.395	2.454	2.461	2.49	2.52	2.486	2.485	2.536	2.528
Denmark	2.045	2.177	–	2.387	2.508	2.575	2.485	2.452	2.463	2.538
Austria	1.781	1.9	1.941	2.067	2.14	2.258	2.255	2.443	2.456	2.565
France	2.139	2.159	2.148	2.197	2.23	2.168	2.15	2.099	2.097	2.081
Canada	1.758	1.795	1.912	2.088	2.041	2.031	2.051	2.014	1.941	1.893
Belgium	1.863	1.938	1.972	2.076	1.943	1.885	1.865	1.838	1.885	1.893
United Kingdom	1.785	1.856	1.848	1.823	1.821	1.779	1.71	1.757	1.779	–
Netherlands	1.895	1.959	1.825	1.804	1.724	1.756	1.782	1.737	1.732	1.727

Source: OECD, 2008.

R&D should not be confused with innovation, however. A company may invest heavily in research and not come up with a single, good idea. In fact, more innovations come from sales and marketing than from R&D. Notwithstanding, without a good R&D effort, it would be hard to translate most of the ideas into innovative products and services. Given that R&D is rarely more than 5% of a company's total revenue, increasing R&D activity would seem to be a winning corporate strategy.

Macro-economic studies and surveys have revealed the following innovation trends:

- Innovation is beneficial to both national economies and corporate performance, but its impact is more visible at the microeconomic than the macroeconomic level;
- innovative companies tend to outperform their peers;
- firms connected to high-tech clusters tend to outperform their peers;
- technical skills of the workforce and IT/telecommunications infrastructure are critical to innovation;
- small countries have an advantage; and
- Return on investment (ROI) is higher in middle-income countries than in rich countries.

3. The Innovation Index

The *Economist Intelligence Unit*, the research unit of *The Economist*, compiled an innovation index whereby they rank countries according some beneficial inputs (enablers) to innovation. The index was originally created in 2007 and updated again in 2009.

Table 2 shows a list of the innovation inputs evaluated by the *Economist Intelligence Unit* to compare and rank individual countries. It consists both of direct influences – such as research and development expenditures by companies, workforce skills and communication infrastructure – and indirect factors, such as government policies towards enterprise, trade and foreign investment.

Table 2: Innovation inputs

Innovation inputs	
Direct innovation inputs (0.75 weight)	***Innovation environment (0.25 weight)***
Research and development (R&D) as % of gross domestic product (GDP)	Political environment
Quality of local research infrastructure	Market opportunities
Education of workforce	Policy towards free enterprise and competition
Technical skills of workforce	Policy towards foreign investment
Quality of information technology (IT) and communications infrastructure	Foreign trade and exchange controls
Broadband penetration	Taxes
	Financing
	The labour market
	Infrastructure

Table 3 shows the list of top countries ranked by their innovativeness. Japan, Switzerland, the United States, Sweden and Finland are at the top of the index. Japan invests heavily in R&D, and more of this R&D is carried out by industry than in the US or EU. Furthermore, Japan has more scientific researchers per head than the US and scores well in terms of the standard of higher education. It has a large share of high-tech activities and scores high in Internet penetration. The economy has a high concentration of high-tech companies, which tend to be more innovation-intensive. Another feature is the symbiotic relationship between these companies and webs of associated small and medium-sized enterprises, which are under strong pressure to innovate.

Table 3: Top positions in global innovation ranking

Japan maintains top position in global innovation ranking

	2002-06		2004-08		Change in rank
	Index	Rank	Index	Rank	2004-08/2002-06
Japan	10.00	1	10.00	1	0
Switzerland	9.71	2	9.71	2	0
Finland	9.43	5	9.50	3	2
US	9.48	3	9.50	4	-1
Sweden	9.45	4	9.44	5	-1
Germany	9.38	6	9.40	6	0
Taiwan	9.28	8	9.37	7	1
Netherlands	9.12	9	9.16	8	1
Israel	9.10	10	9.13	9	1
Denmark	9.29	7	9.08	10	-3
South Korea	8.78	15	8.94	11	4
Austria	8.91	11	8.93	12	-1
France	8.90	12	8.88	13	-1
Canada	8.84	13	8.87	14	-1
Belgium	8.80	14	8.79	15	-1
Singapore	8.72	17	8.76	16	1
Norway	8.73	16	8.73	17	-1
UK	8.72	18	8.72	18	0
Ireland	8.46	19	8.50	19	0
Australia	8.37	21	8.50	20	1
Hong Kong	8.16	23	8.44	21	2
Italy	8.41	20	8.44	22	-2
New Zealand	8.17	22	8.24	23	-1
Slovenia	7.68	24	7.74	24	0
Cyprus	7.34	26	7.62	25	1

The high rank for the three small wealthy European states (Switzerland, Finland and Sweden) reflects the fact that their economic, social and political conditions favour innovation. In addition, there are specific factors that stimulate innovation, including highly skilled labour forces, a long-standing policy support for R&D, and specialization in innovation-intensive industries such as telecommunications, biopharmaceuticals, and machine tools and precision instruments.

The slippage of the US relative rank confirms the gradual erosion in recent years of the country's traditional position as the world's technological leader. To some extent, the erosion in the US's position reflects the fact that other countries are catching up. But it is also a result of the weakening US innovation environment—and this is likely to be accentuated by the current economic crisis.

4. Innovation Efficiency

Not all countries, however, use their innovation inputs with equal efficiency. A comparison of a country's rank on its innovation performance with its ranking on direct innovation inputs can provide an insight into its level of innovation efficiency. A large discrepancy in the two rankings suggests either a high level of efficiency (high innovation output relative to inputs) or a high degree of inefficiency if the direct inputs rank exceeds significantly a country's ranking on innovation performance.

Table 4: Discrepancies between innovation performance and innovation enablers

2004–2008	Innovation performance			Innovation enablers					
	Patents per m	Innovation performance index	Rank	Direct inputs index	Rank	Innovation environment index	Rank	Aggregate innovation enablers index	Rank
Japan	1,274.533	10.00	1	9.81	9	7.11	23	9.14	11
Switzerland	505.839	9.71	2	9.94	2	8.54	6	9.59	4
Finland	363.298	9.50	3	9.94	2	8.60	3	9.60	3
USA	359.840	9.50	4	9.88	8	8.47	8	9.52	5
Sweden	330.980	9.44	5	10.00	1	8.49	7	9.62	2
Germany	310.695	9.40	6	9.94	2	8.07	13	9.47	6
Taiwan	293.642	9.37	7	9.50	11	7.46	22	8.99	15
Netherlands	212.411	9.16	8	9.56	10	8.45	9	9.28	8
Israel	199.801	9.13	9	9.94	2	6.83	27	9.16	10
Denmark	184.985	9.08	10	9.94	2	8.70	1	9.63	1
South Korea	148.704	8.94	11	9.50	11	6.30	44	8.70	18
Austria	147.317	8.93	12	9.06	17	7.57	18	8.69	19
France	136.223	8.88	13	9.94	2	7.51	21	9.33	7
Canada	132.635	8.87	14	9.50	11	8.25	11	9.19	9
Belgium	116.899	8.79	15	9.06	17	7.88	17	8.77	17
Singapore	111.307	8.76	16	8.81	19	8.66	2	8.77	16
Norway	106.668	8.73	17	8.81	19	7.95	14	8.60	20
UK	105.211	8.72	18	9.25	15	8.54	5	9.07	13
Ireland	73.814	8.50	19	9.19	16	8.60	4	9.04	14
Australia	73.511	8.50	20	9.50	11	7.92	16	9.11	12
Hong Kong	67.328	8.44	21	8.13	24	8.30	10	8.17	22
Italy	66.909	8.44	22	7.88	27	6.41	39	7.51	27
New Zealand	48.740	8.24	23	8.25	21	8.13	12	8.22	21
Slovenia	22.040	7.74	24	8.25	21	6.29	45	7.76	26
Cyprus	18.237	7.62	25	6.06	40	7.03	24	6.31	36
Spain	15.367	7.51	26	7.94	25	7.51	20	7.83	24
Hungary	9.061	7.18	27	7.69	28	6.78	28	7.46	28
Czech Republic	5.533	6.87	28	8.19	23	6.55	34	7.78	25
Croatia	5.116	6.82	29	6.50	34	5.51	58	6.25	37
Estonia	4.704	6.76	30	7.94	25	7.55	19	7.84	23
Malaysia	4.237	6.70	31	6.44	36	6.55	35	6.46	33
Greece	3.856	6.64	32	5.88	42	6.23	47	5.96	43
Portugal	3.612	6.60	33	7.00	31	6.92	26	6.98	30
South Africa	3.496	6.58	34	5.56	48	6.23	46	5.73	47
Costa Rica	2.429	6.35	35	5.88	42	6.54	36	6.04	42
Slovakia	1.836	6.17	36	7.31	29	6.72	29	7.16	29
Kuwait	1.794	6.16	37	4.75	56	6.01	48	5.06	57
Lithuania	1.563	6.07	38	6.56	32	6.40	40	6.52	31
Russia	1.460	6.03	39	7.13	30	4.61	74	6.50	32
UAE	1.329	5.97	40	5.88	42	6.94	25	6.14	40
Argentina	1.322	5.96	41	6.13	38	5.94	52	6.08	41

Note: Patents data are averaged over 2004-07 and expressed as patents per million population for each country.
The innovation enablers indexes are based on the averge for 2004-08.

Table 4 shows that Japan, for example, is highly efficient: it is top-ranked in innovation performance in 2004-08, but only 11th in the index that measures the environmental factors that are conducive to innovation. Japanese innovators are therefore swimming upstream. Japan is a resource-poor economy with a greying population that has long taken an “innovate or die” approach.

The central and east European countries, in contrast, achieve unusually low returns on their direct innovation inputs. This may be partly because these countries had highly educated workforces and large scientific establishments under socialism, and partly because these scientists and researchers have not moved with the times by integrating into the global economy. This has resulted in a poor innovation performance.

5. Innovation Trends and Forecasts

The *Economist Intelligence Unit* expects the severe business downturn and the global economic crisis will have a negative impact on countries' long-term ability to innovate. While developed countries will continue to top the list of innovators in the medium term, poor business conditions will impair their innovation capacity. But China and India are among the countries that will continue to gain ground.

Overall, innovation at a global level is expected to advance at a significantly slower pace over the next five years than was previously forecast. The current financial turmoil will affect a variety of the innovation inputs that directly drive innovation. It is likely to result in a reduction of investment in research and development (R&D), spending on training and education, and the quality of information and communications technology (ICT) infrastructure. The economic crisis will also have a negative impact on certain aspects of the environment that enable innovation—access to finance for firms, conditions for entrepreneurship, and economic and political stability. The recession will constrain both public and private R&D spending. It will also limit governments' spending on education and training as well as support for innovation activities.

The most important expected changes in the environment include poor conditions for financing investment; a deterioration in macroeconomic and political stability and in fiscal conditions in many countries; and unfavourable developments in institutional and regulatory environments. The forecast is not based on a worst-case scenario, and a gloomier outcome remains a possibility.

Table 5: Expected trends in innovation performance and innovation inputs

2009–2013	Innovation performance				Innovation enablers					
	Expected innovation performance index	Rank	Growth expected during the next 5 years (%)	Expected change in rank	Expected direct inputs index	Rank	Expected innovation environment index	Rank	Expected aggregate innovation enablers index	Rank
Japan	10.00	1	0.0	0	9.94	9	6.97	28	9.20	11
Switzerland	9.70	2	-0.2	0	10.00	1	8.28	7	9.57	4
Finland	9.53	3	0.3	0	10.00	1	8.52	3	9.63	1
USA	9.44	5	-0.6	-1	10.00	1	7.86	14	9.47	6
Sweden	9.42	7	-0.2	-2	10.00	1	8.41	6	9.60	3
Germany	9.49	4	1.0	2	10.00	1	8.25	8	9.56	5
Taiwan	9.44	6	0.7	1	9.63	10	7.34	21	9.05	14
Netherlands	9.16	9	-0.1	-1	9.63	10	8.22	10	9.27	8
Israel	9.20	8	0.8	1	10.00	1	6.93	31	9.23	9
Denmark	9.06	10	-0.2	0	10.00	1	8.44	4	9.61	2
South Korea	9.05	11	1.2	0	9.50	13	6.73	35	8.81	17
Austria	8.98	12	0.6	0	9.19	18	7.39	20	8.74	19
France	8.96	13	0.9	0	10.00	1	7.66	17	9.42	7
Canada	8.83	15	-0.4	-1	9.50	13	8.10	11	9.15	12
Belgium	8.89	14	1.2	1	9.25	15	7.73	16	8.87	16
Singapore	8.75	16	-0.1	0	8.88	19	8.43	5	8.76	18
Norway	8.75	17	0.2	0	8.88	19	7.82	15	8.61	20
UK	8.58	19	-1.6	-1	9.25	15	7.93	13	8.92	15
Ireland	8.57	20	0.9	-1	9.25	15	8.74	1	9.12	13
Australia	8.61	18	1.4	2	9.63	10	8.05	12	9.23	10
Hong Kong	8.46	22	0.2	-1	8.06	23	8.57	2	8.19	22
Italy	8.46	21	0.3	1	7.94	26	6.31	45	7.53	28
New Zealand	8.40	23	2.0	0	8.44	21	8.22	9	8.38	21
Slovenia	7.80	24	0.9	0	8.25	22	6.58	37	7.83	24
Cyprus	7.72	25	1.4	0	6.13	43	7.21	23	6.40	38
Spain	7.50	26	-0.1	0	8.00	24	7.28	22	7.82	25
Hungary	7.28	27	1.5	0	7.81	28	6.86	33	7.57	27
Czech Republic	6.79	31	-1.0	-3	7.94	26	6.98	26	7.70	26
Croatia	7.16	28	5.1	1	6.75	32	6.07	54	6.58	34
Estonia	6.82	30	0.9	0	8.00	24	7.64	18	7.91	23
Malaysia	6.57	35	-1.9	-4	6.38	37	6.22	48	6.34	40
Greece	6.75	33	1.7	-1	6.00	45	6.26	46	6.06	45
Portugal	6.79	32	2.9	1	7.25	29	6.98	27	7.18	30
South Africa	6.94	29	5.5	5	5.94	47	6.39	44	6.05	48
Costa Rica	6.69	34	5.4	1	6.19	42	6.94	30	6.37	39
Slovakia	6.19	38	0.3	-2	7.19	31	7.20	24	7.19	29
Kuwait	6.25	36	1.6	1	4.81	60	6.15	52	5.15	58
Lithuania	6.14	40	1.1	-2	6.63	35	6.50	40	6.59	33
Russia	6.14	39	1.9	0	7.25	29	4.74	69	6.62	32
UAE	6.07	44	1.7	-4	6.06	44	6.79	34	6.25	42
Argentina	6.08	42	2.0	-1	6.31	40	5.86	58	6.20	44

From Table 5 it follows that innovation performance trends will vary among countries. Because so many emerging markets start from a low base, their overall innovation performance is still likely to improve, but at a slower pace than previously expected.

The *Economist Intelligence Unit* expects some shifts among the top countries in 2009-13 compared with 2004-08. Japan, Switzerland and Finland remain the first-, second- and third-ranked countries respectively. Germany rises to 4th from its previous 6th position, pushing the US to 5th place and Sweden out of the top five.

Table 6: Changes in top innovation rankings

Current and forecast innovation index

	2004-08		2009-13		Change in rank
	Index	Rank	Index	Rank	2009-13/2004-08
Japan	10.00	1	10.00	1	0
Switzerland	9.71	2	9.70	2	0
Finland	9.50	3	9.53	3	0
US	9.50	4	9.44	5	-1
Sweden	9.44	5	9.42	7	-2
Germany	9.40	6	9.49	4	2
Taiwan	9.37	7	9.44	6	1
Netherlands	9.16	8	9.16	9	-1
Israel	9.13	9	9.20	8	1
Denmark	9.08	10	9.06	10	0
South Korea	8.94	11	9.05	11	0
Austria	8.93	12	8.98	12	0
France	8.88	13	8.96	13	0
Canada	8.87	14	8.83	15	-1
Belgium	8.79	15	8.89	14	1
Singapore	8.76	16	8.75	16	0
Norway	8.73	17	8.75	17	0
UK	8.72	18	8.58	19	-1
Ireland	8.50	19	8.57	20	-1
Australia	8.50	20	8.61	18	2
Hong Kong	8.44	21	8.46	22	-1
Italy	8.44	22	8.46	21	1
New Zealand	8.24	23	8.40	23	0
Slovenia	7.74	24	7.80	24	0
Cyprus	7.62	25	7.72	25	0

Although EU countries rank high in the index their gains are not significant. Six EU countries are expected to record a decline in innovation performance and the average (unweighted) innovation performance index for the 25 EU countries in our sample improves only slightly, from 7.6 in 2004-08 to 7.7 in 2009-13 (Malta and Luxembourg are not covered in the index). Despite the EU's efforts to boost innovation performance and a small expected decline in US performance, the region will make little progress in closing the innovation gap with Japan and the US over the next five years.

China is the biggest gainer among all economies, developed and emerging. Its innovation performance will improve by 11% and it will rise from 54th to 46th place between 2004-08 and 2009-13. India will move up four places, whereas the rankings for the two other BRIC countries, Brazil and Russia, remain unchanged.

One reason for the jump is that China is making a concerted effort to build a more innovative economy. The country is investing heavily in R&D and education, and its innovation environment is improving. In real terms, China's R&D spending grew by 19% per year in 2001-06, and R&D as a share of GDP reached 1.4% in 2006. The government's target is to

reach 2% by 2010. Based on its recent progress, China will reach this target—if not in 2010, then soon after.

China now leads the world in the number of people engaged in science and technology. The country accounted for 6% of the number of scientific articles published worldwide in 2005, up from 1.6% in 1995, and it is ranked fifth globally. University graduates with degrees in science and engineering represent 40% of the total, almost twice the OECD average and far above the 15% recorded in the US.

Much of China's FDI will continue to target innovation-intensive sectors, and foreign companies have been opening research centres in the country. The prospects for China are not entirely positive; it also faces barriers to innovation. Weak protection of intellectual property (despite improvements in recent years) stands out.

The US will remain an innovation powerhouse and retain its significant lead over the EU as a whole, even though its position is slipping. Its innovation performance in 2009-13 is forecast to decline slightly compared with the average in the previous five years. R&D as a share of GDP has declined from 2.8% in 1996 to 2.6% in 2006, but is still almost double the ratio in China, according to the OECD. In the same period, the growth in patent filings by US residents has slowed, while other countries continue to catch up. The US share of total OECD technology exports has also fallen. In 2005 it accounted for 15.6% of OECD high- and medium-high technology exports, compared with 18.4% in 1996. Growth in the number of researchers has slowed relative to China and some EU countries, and a smaller proportion of graduates obtain degrees in science and engineering than in those countries.

The current economic crisis is likely to exacerbate these downward trends in innovation. However, under the Obama administration in the US, the focus on long-term investments in such areas as environmental technology and education as set forth in the economic recovery plan may help at least to slow the decline.

6. Summary

Heightened global competition is forcing both governments and companies to find new ways to increase productivity. They have little choice but to innovate, or at least to encourage the innovators.

There is no single, right method to promote and enable innovation. Consider, for example, the diversity of the countries at the top of the ranking. Some are large and some are small. Some value learning, others improvisation and spontaneity. Innovation is certainly not a Western preserve; witness the position of Japan at the top of the innovation ranking, as well as the strong performance of Taiwan and Singapore, not to mention the emergence of China. All heavily emphasise the use of government policies to encourage innovation, along with educational systems that produce large numbers of scientists and engineers.

Despite the diverse reasons for success in innovation, some common themes emerged from the study:

- There is no real substitute for a good education—and a good education system. Whether you are China or BMW, it is highly advantageous to be able to tap deep, wide reservoirs of technical expertise.

- Investments in IT and communications infrastructure provide a good pay-off in terms of innovation.

- Sizeable spending on R&D is likely to yield dividends in terms of new products and services.

- Irrespective of performance, the pace of innovation overall is faster than ever. Seventy-one percent of those responding to our survey said that more than one-half of their sales came from products and services that are five years old or less.

- Innovative scientists and researchers work best when given a high degree of autonomy, and then allowed to work closely with the business functions to put ideas into effect.