E-readiness in Nordic Countries

How long will the stars keep shining ?

In a world characterized by the growing importance of knowledge, information and technology as sources of competitiveness and comparative advantage, the hierarchy of world champions is less and less stable. New competitors emerge every day in seemingly unassailable sectors of activity. Rankings of different kinds are being reshuffled on an almost continuous basis. Yet, in the context of 'e-readiness' - as measured by one of the most authoritative and longstanding index available, i.e. the WEF-INSEAD Network Readiness Index -, the Nordic countries (Denmark, Finland, Iceland, Norway and Sweden) have displayed so far a consistent and outstanding performance: year after year, those five countries keep appearing in the 'top ten' of e-readiness.

How can this remarkable situation be explained ? Can it be replicated by other economies ? And, if so, how long will the Nordic stars outshine other up-and-coming champions of the global information economy ?

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This White paper is accompanied by a dedicated website

http://www.networkedreadiness.com/nordic/

In addition to the basic NRI data for Nordic countries, this site provides a certain number of tools to compare individual country performances, as well as to identify their relative strengths and weaknesses across the various components and sub-components of the Network Readiness Index.

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As competition becomes truly global, advanced economies realize that their present and future strategies need to focus on their only potential source of longer-term comparative advantage, namely knowledge. The acquisition, building and sharing of knowledge across national economies has hence become the focus of some of the most ambitious and forward-looking strategies among OECD countries over the last decade. In such strategies, knowledge is the core of an organic set of mechanisms, which eventually allows societies to grow harmoniously and innovatively. For such a model to function, however, a certain number of prerequisites must be present, which include the institutions, the infrastructure, and the incentives without which knowledge cannot be built, transmitted or shared. Education systems, information networks, innovation policies are some examples of such prerequisites. By measuring their density and performance, one can obtain a rather telling picture of how ready a particular national economy is to face the challenges of the emerging global information and knowledge economy, often referred to as 'e-readiness'.

Over the last seven years, Nordic countries (Denmark, Finland, Iceland, Norway and Sweden,) have been the shining stars of e-readiness as measured by the most authoritative and longest standing index available: the Network Readiness Index[1]. The NRI permits business leaders and public policymakers to investigate the reasons leading to a nation's ranking and relative performance. It captures key factors relating to the environment, readiness and usage of the three main stakeholders in ICT (individuals, businesses, and governments) and can be used to understand the performance of a nation or even a region with regards to ICT development.

[1] Since 2001, NRI rankings have been published annually in the Global Information Technology Report (GITR). Initially developed by the World Economic Forum and Harvard University, the NRI has been jointly monitored since 2002 by the World Economic Forum and INSEAD, covering an increasingly large sample of countries (currently 122).

Denmark steadily improved its aggregate readiness performance relative to the other 100+ countries of the analyzed sample, and became No1 in 2006. The world champion of 2001, Finland saw its competitiveness challenged by other rising stars (such as Singapore, the USA) in subsequent years, but never fell below fifth place. Sweden seemed to lose ground progressively between 2001 and 2005, before jumping to second place in 2006. Iceland followed a more volatile path, but always remained in the 'top ten', a group that was eventually joined by Norway in 2006.

As a group, the Nordic countries have clearly been the 'e-readiness champions' of the past decade

NRI Rank	2001-02	2002-03	2003-04	2005-05	2005-06
1	Finland	USA	Singapore	USA	Denmark
2	US	Singapore	Iceland	Singapore	Sweden
3	Singapore	Finland	Finland	Denmark	Singapore
4	Sweden	Sweden	Denmark	Iceland	Finland
5	Iceland	Denmark	USA	Finland	Switzerland
6	Canada	Canada	Sweden	Canada	Netherlands
7	U.K.	Switzerland	Hong Kong	Taiwan	USA
8	Denmark	Norway	Japan	Sweden	Iceland
9	Taiwan	Australia	Switzerland	Switzerland	U.K.
10	Germany	Iceland	Canada	U.K.	Norway

Figure 1 : Networked Readiness Index top ten (2001-2007)

It is hence not surprising that a large number of analysts have tried to identify 'Nordic best practices' and ways in which the experience of Nordic countries could be emulated with regard to e-readiness. By taking a closer look at the 'story (and data) behind the story', this paper attempts to identify the factors which best explain the consistent high performance of the Nordic countries in terms of e-readiness. By the same token, it also tries to point at some of the perceived or latent weaknesses which could prevent the Nordic countries from remaining the champions of the world in this area. The last section of the paper lists some of the policies and actions required to maintain such an outstanding performance, or at least to prevent it from deteriorating.

The story

What does such a strong NRI performance actually tell us about Nordic economies?

Any attempt to measure an item as complex as that of 'e-readiness' is faced with a number of challenges and limitations. Such challenges and limitations become even more daunting when one attempts to rank countries, which supposes that several sub-indicators are aggregated into one single figure.

It is therefore important to acknowledge from the start what such an index/ranking says, and what it does not say. From a policy point of view, it allows to project a rather striking picture of 'who is ahead'. From a slightly more analytical point of view, it offers a way to assess how a particular country does a cross time, by comparing its performance from year to year.

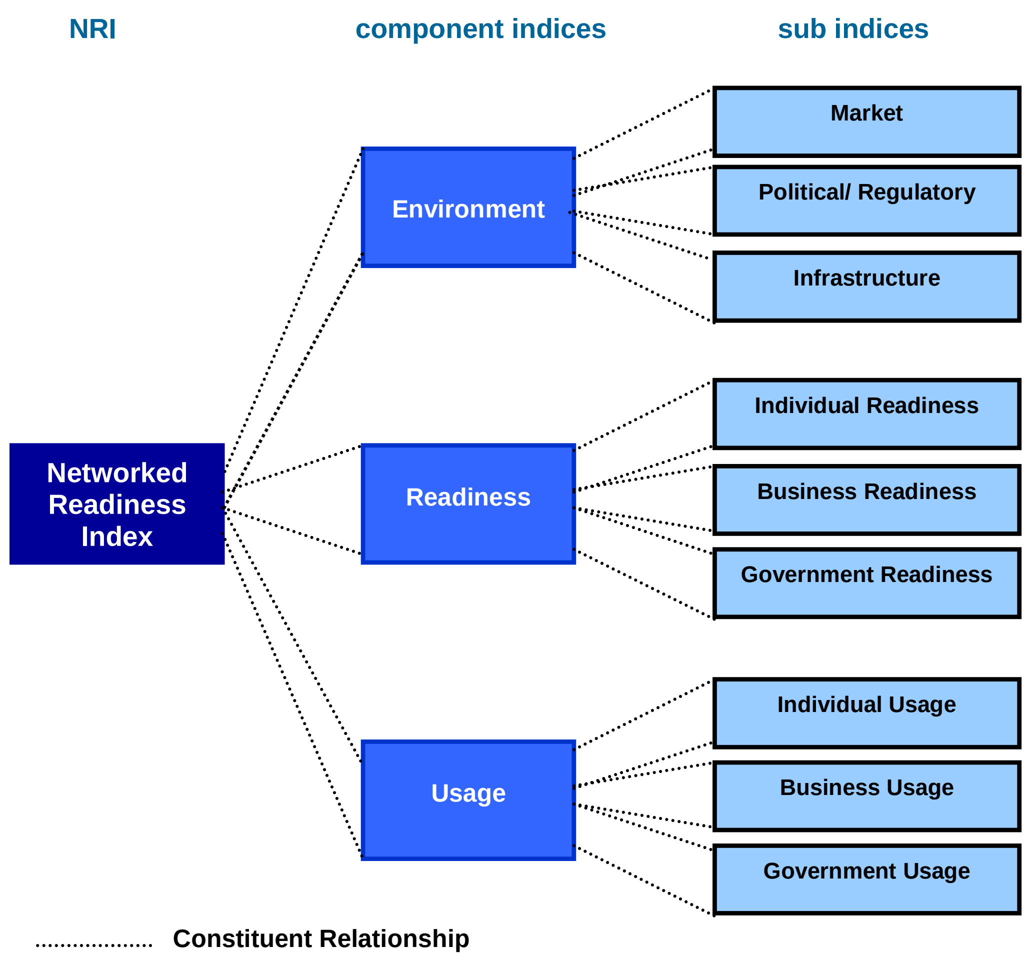
In an information-driven world economy, no country can hope to continuously outperform its competitors

The most important characteristic of such an index (and of its consequent ranking), however, is that it is relative. In other words, if the ranking of a particular country deteriorates from one year to the next, it does not necessarily mean that its policies, strategies, investment decisions have changed for the worse; it indicates that they have been of lesser quality or impact than those of its competitors.

In today's information-driven economy, no country can hope to continuously outperform its competitors. 'Staying on top' is a never-ending job, which requires quick adaptation, innovativeness and the ability to identify and adopt best practices 'on the fly'.

Yet, this is precisely what the Nordics seem to have done in the last decade : remaining on top. Explaining why this was so and whether such high-level performance can be replicated in the future, however, requires a deeper exploration of the NRI methodology.

The NRI is a combination of some 67 variables[2], themselves grouped into 9 sub indices. From those 9 sub-indices, 3 major component indices are built (environment, readiness and usage), which are then aggregated into a single index, the NRI.



Source: INSEAD

Figure 2 : The Networked Readiness Index Framework

The 'environment' component includes items such as a country's regulatory regime or legal framework for ICT, or the availability and quality of IT infrastructure. The second pillar (readiness) looks at actual levels of networked readiness of the three main subsets of stakeholders in the economy: individuals, businesses, and governments. Finally, the actual levels of usage of ICT by those same three groups constitute the ingredients of the third pillar of the NRI (usage).

[2] The 67 data used for NRI computations include hard data (typically statistics collected by the ITU or the World Bank for example) and soft data, mostly derived from the World Economic Forum's Annual Executive Opinion Survey.

The strong and persistent NRI performance of Nordic countries clearly tells us that they enjoy a range of solid ICT and knowledge-related assets, and that such assets find in the socio-economic environment of those countries a fertile terrain, favouring a wide-spread use of ICT across their societies.

History and geography combine to make Nordic countries ideal contenders in a globalized knowledge economy

It is clear that some of the characteristics shared by all Nordic countries (such as a high level of general education), combined with a number of geographical and historical factors (such as a long-established tradition of sharing knowledge among themselves, a lack of many raw materials and commodities, the process of European integration, and – for Finland at least – the collapse of long-standing trade relationship with Eastern Europe) have played a significant role in stimulating interest for developing the bases of information- and knowledge-intensive societies.

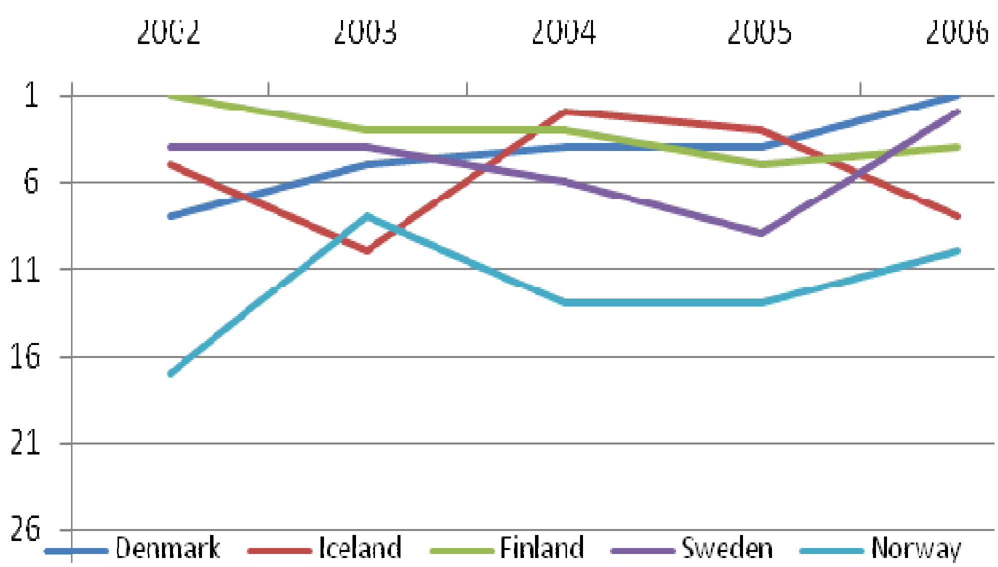


Figure 3 : Nordic Countries NRI Ranking 2001-06

However, to better understand the sources of this high performance, one needs to take further advantage of the structure of NRI, i.e. to drill down from the overall index to component indices, sub-indices and eventually individual indicators. This should allow a better identification of those areas where the relative strengths of the Nordic countries have been particularly remarkable.

The story behind the story ?

Nordic Strengths and Weaknesses in a Global Information Economy

Any hero has its Achilles heel. Knowing one's weaknesses is a first necessary step to correct or counterbalance them.

Because of their remarkable performance in terms of e-readiness, the Nordic countries are obviously among the main contenders the upcoming global knowledge economy.

Yet, in this new context, other players have also made headways towards the first ranks. India can align legions of engineers and high-level scientists. The large economies of the OECD are reshuffling their production factors towards knowledge-intensive activities. Smaller countries follow the trail blazed not so long ago by Singapore, Estonia and other successful niche players. Newcomers such as the energy rich countries of the Persian Gulf (Qatar, the United Emirates, even Saudi Arabia) are setting up knowledge strategies and knowledge cities, and trying to attract the best talents globally.

In such a rapidly moving environment, what are the areas in which the Nordic countries can still hope to improve their e-readiness performance? What are the weaknesses that they need to address before they become serious handicaps on their road to global competitiveness ?

If such weaknesses can be identified, which type of corrective action can be considered, and how could it be implemented ?

To answer those questions, one needs a combination of candidness and imagination, but also a rather rigorous and systematic look at the various components of e-readiness.

Excelling in to-morrow's global knowledge economy will mean competing with India's legions of engineers, Estonia's inventiveness, or Qatar's vision : what could prevent Nordic countries from being successful at it ?

The Environment Component Index

The environment component of the NRI measures the type of market environment in which ICT firms operate, the political, fiscal and regulatory framework which they have to respect, and the ICT infrastructure that prevail in the country. In other words, it provides an aggregate indicator of some of the longer-term conditions under which ICTs and their usage can develop in a particular country. This environment component hence has a direct impact on the other two components of the NRI, namely readiness and usage.

Nordic countries enjoy high-level IT infrastructure, as well as top quality political/regulatory frameworks

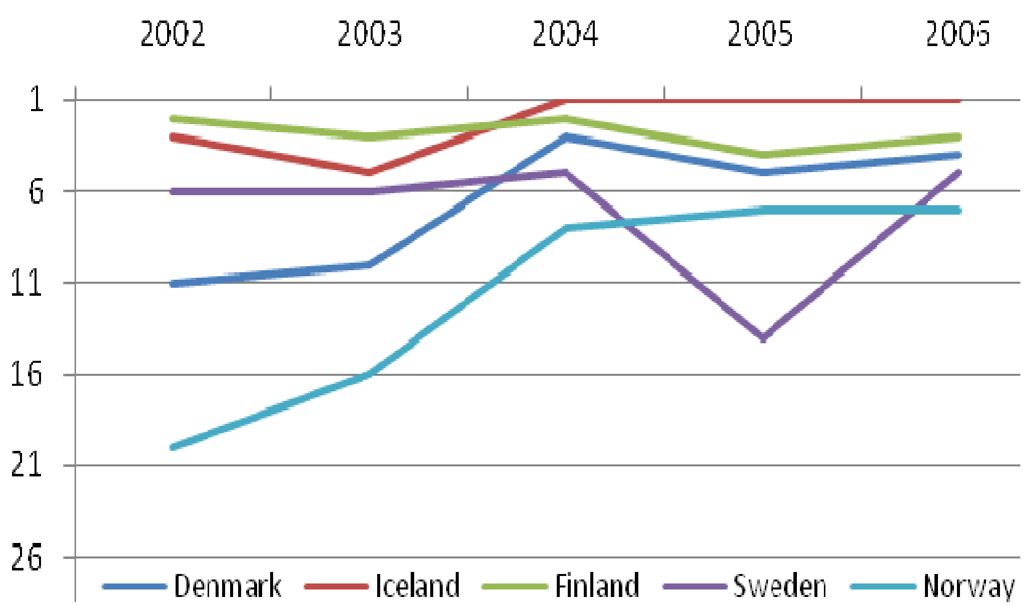


Figure 4 : Nordic Countries - NRI 'Environment' index rankings

With the notable exception of the Swedish drop of 2005, this is the component in which the collective star performance of the Nordic countries is the more visible: the high level of the Nordic ICT infrastructure, and the quality of the political and regulatory framework provided by Nordic governments have been pushing this component upward after 2003.

The Readiness Component Index

The Readiness of a nation measures the capability of the principal agents of an economy (citizens, businesses, and governments) to leverage the potential of ICT. It reflects a combination of factors, including the presence of relevant skills to produce and use ICTs and relevant services (e-skills) at individuals' level, access and affordability of ICT for corporations, and government use of ICT for its own services and processes (typically e-government).

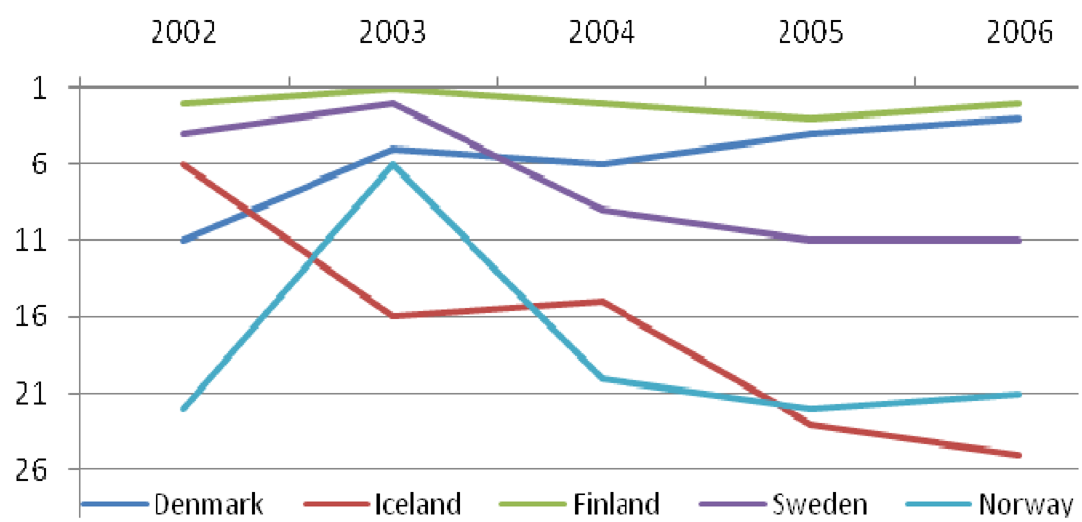


Figure 5 : Nordic Countries - NRI 'Readiness' index rankings

In 2003 Finland ranked first on overall Readiness, showing a consistent performance across all three readiness sub indices (citizens, business and government). Sweden was in 2nd place, thanks to a very strong performance in Individual and Business Readiness, while Denmark and Norway were in 5th and 6th positions respectively. After 2003, Finland and Denmark maintained their performance, while Sweden , and even more so Norway and Iceland have experienced a significant and steady decline until 2006.

After 2002-2003, Finland, Denmark stayed on top but Sweden, Norway, Iceland slipped

The Usage Component Index

The Usage component of NRI aims to measure the degree of usage of ICT by all major groups of stakeholders (individuals, firms, and government). It provides an indication of the changes in behaviours, lifestyles, and other economic and non-economic benefits brought about by the adoption of ICT. It also indicates how a specific society is actually turning its advantages (environment and readiness) into actually using ICTs to promote a dynamic and competitive knowledge society.

Across all five Nordic countries, Internet-based convergence has become a fact of daily life

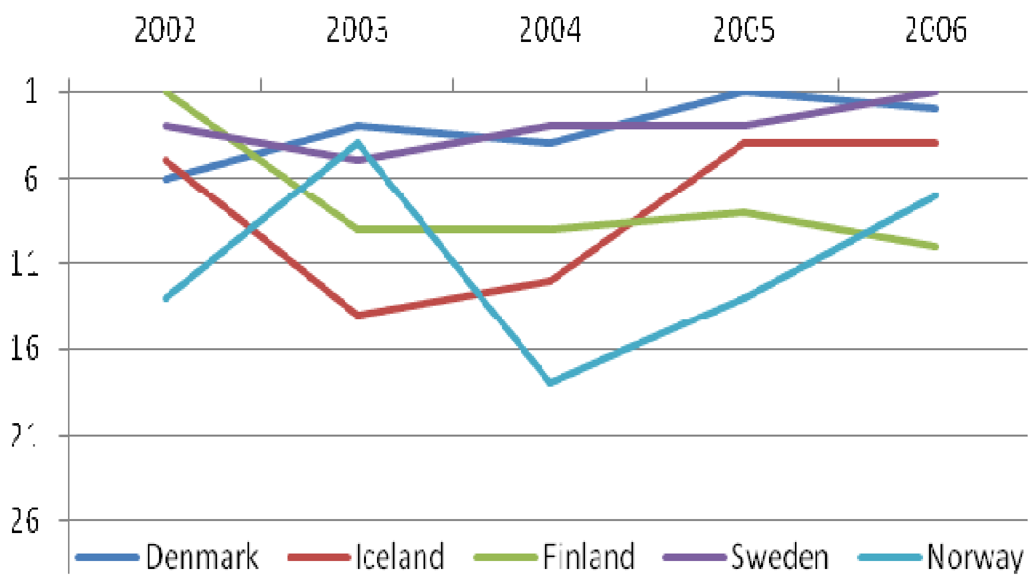


Figure 6 : Nordic Countries - NRI 'Usage' index rankings

There also, the Nordic countries are shining : in 2006, 59% of Norwegian households had broadband, from only 20% in 2002. During the same period, total electronic communication turnover increased by 19%, mostly due to mobile and Internet growth. During the same period, the share of turnover generated by fixed lines decreased from 48 to 26%, indicating that, across all Nordic countries, Internet-based convergence has become a fact of daily life.

Stars among the stars ?

How Nordic countries compare with other leading economies

Comparing the Nordic countries to the other members of the 'NRI top ten' reveals significant structural differences and areas of relative competitiveness

Since 2001, Singapore, Switzerland, the Netherlands, the United States and the United Kingdom have been the main competitors of Nordic countries for the top positions in the NRI.

The NRI 'top ten' in 2006-2007
1. Denmark
2. Sweden
3. Singapore
4. Finland
5. Switzerland
6. Netherlands
7. USA
8. Iceland
9. United Kingdom
10. Norway

Singapore has lower taxes and higher e-skills

Singapore has made extensive usage of ICT, and posts a strong performance in 'procurement of advanced technology' and in 'privatization of ICT' [3]. From a business point of view, ICT is accessible and affordable. Other key strengths of Singapore over other NRI leaders include its low level of taxation and its high level of hi-tech exports. Moreover, Singapore is particularly 'innovation-ready', because of its high number of scientists and engineers, and the remarkably high level of education of its population, especially in mathematics and sciences. E-skills are also exceptionally strong in all sectors of the Singaporean economy.

[3] As mentioned by an executive: "The launch of Singapore's new 10-year Infocomm Masterplan in 2005 -- the Intelligent Nation 2015 -- is strengthening the country's competitiveness as we continue to embrace information and communication technologies to enable social and economic growth".

Switzerland's good e-Readiness ranking owes a lot to the its highly skilled workforce. Over the last few years, the country's e-readiness has been enhanced by an increase in government spending on ICT, which contributed to stimulate service and product innovation across the Swiss IT industry. Over the last two years, an increasingly competitive telecom environment and a strong cable TV industry have combined to generate a healthy growth in broadband adoption. The burgeoning online shopping market has led global e-commerce leaders such as eBay to establish a presence in the country. The Swiss Government has also helped building a more competitive national environment by increasing the flexibility of the labour market.

Switzerland's strong e-skills and innovation tradition are strengthened by growing public spending in ICT and increased flexibility in labour markets

In **the Netherlands**, the Government has advertised its ambition to turn the country into the European leader in ICT. The backbone of its strategy is to bring research and development, business and government together to start new businesses and developing innovative high technology products. In addition to the presence of giants such as Philips, the country can count on a level of Internet penetration of 70 per cent, i.e. among the highest in Europe. The Netherlands' location, and its easy links with the main centers of activity in Europe already attracted a large number of international ICT companies (Cisco, Dell, Abaco), who chose the country as their strategic hub for penetration of the European market.

The Netherlands ambition to be a European leader in ICT finds credibility in its success to attract major players of the sector

With 280 million consumers, **the USA** enjoys the world's largest domestic market, both as a producer and as a consumer of ICT products and services. This US$ 812.6 bn market offers unrivaled opportunities to develop and test innovative technology solutions before attacking global markets. Currently helped by a weak dollar, US ICT exports also remain high. Additional US advantages include extensive venture capital availability, ease to obtain patents, quality of management schools and scientific research institutions. The credit squeeze of 2007 has affected the commercial spending in financial services, telecoms and hi-tech sectors, but federal and state governments spending has remained high : from 2002 to 2007, US federal government spending on information systems and services has increased from $37.1 billion to $66.4 billion[4] .

The size of the US domestic market, helped by massive public spending, makes it a resilient powerhouse of ICT innovation

[4] The US Department of Defence accounts for 47% of total expected federal spending on information systems and services for 2008

The United Kingdom's high NRI ranking is due in part to its good IT infrastructure[5], but also to its risk-free business environment, strong support for private enterprise, and thriving competition across all sectors of the economy. Since 1998, U.K. taxation has become increasingly IT-friendly: a number of IT goods are exempt from import duties. Although recent weaknesses related to security of e-transactions, and data generally (including the recent loss of tax data by H.M.'s Government) may affect the country's e-readiness ranking in the future, the objectives set out by the ambitious 2005 strategy ('*Transformational Government – Enabled by Technology*') should be reached at the end of 2007, in terms of effective delivery of e-services to citizens and businesses. A most successful endeavor has been that of DirectGov (2.1M visits a month), which now has a local offspring (Local DirectGov), supporting 379 local authorities in making their services available online. Business Link (600,000 visits a month) offers grants and support service to businesses, the site has recently launched 50 online tools to help company owners/managers deal with red tape.

With good IT infracstructure, the UK has used public portals and e-government services to push its IT advantage. Local (e.g. cities) e-government is now a priority

*

Clearly, **the Nordic countries** can find inspiration on some of the strategies and best practices of the other e-readiness champions. If some of their advantages are not easily replicable (such as the size of the US market), others can be emulated, including through a higher flexibility of labor markets and business-related regulation, or a higher level of involvement by the public sector.

It is also important for the Nordic countries to consider that a continued low performance on some NRI sub-indices may hamper further improvements in e-readiness.

When one compares the rankings of Nordic countries to those of other 'top ten countries' in specific areas (e.g. the number of procedures to start a business, or the number of days to enforce a contract), striking differences start to appear.

[5] The penetration rate of broadband technology in the UK reached 20.2% in October 2006, significantly higher than the European Union average of 15.6%. The UK has the highest number of verified public Wi-Fi hotspots in Europe and the second highest globally behind only the US.

In the following table (where a higher number denotes a lower ranking, and hence an area of particular weakness), Nordic countries generally emerge as suffering from handicaps in at least three areas: business-related administrative procedures, communication costs, and to some extent e-skills and openness to foreign technologies.

	DK	FIN	ICE	NOR	SWE	NETH	SING	SWIT	UK	USA	Avg
Environment											
Extent and effect of taxation	113	98	6	51	115	39	7	15	25	30	**49.9**
No of procedures to start a business	111	111	102	108	111	16	91	16	16	102	**78.4**
No of days to enforce a contract	107	102	78	94	106	51	115	13	15	89	**77**
No of procedures to enforce a contract	114	72	115	115	105	23	61	23	9	111	**74.8**
Time required to start a business	112	98	112	99	94	11	111	30	24	112	**80.3**
Readiness											
e-government readiness index	1	9	14	9	3	12	7	17	4	1	**7.7**
Business monthly telephone subscription	103	103	114	105	114	13	109	8	23	77	**76.9**
Government procurement of advanced technology	15	13	45	34	18	16	1	6	31	10	**18.9**
Government privatisation of ICT	11	14	15	23	21	26	1	21	16	24	**17.2**
Quality of Educational system	5	1	3	17	24	18	2	4	29	15	**11.8**
Quality of math and science education	20	2	33	54	36	15	1	4	36	41	**24.2**
Monthly broadband subscription charge	94	83	87	98	91	1	80	1	6	104	**64.5**
Government ICT vision	9	16	8	21	23	46	1	45	28	38	**23.5**
Usage											
ICT use and government efficiency	5	17	3	20	10	23	2	30	33	20	**16.3**
Foreign technology licensing	31	33	20	24	17	3	2	15	19	23	**18.7**
Government success in ICT promotion	14	16	9	25	18	34	1	30	55	28	**23**

Figure 7 : ’Top Ten’- selected NRI sub-indices rankings

Clearly, the Nordic group has a great potential for improving its business environment, namely through the reduction, simplification and streamlining of administrative procedures required to start, close or run a business. In terms of market environment, it is much easier to locate a new business in Singapore, Switzerland or the U.K than in a Nordic country. Electronic communication costs for businesses (telephone or broadband) are also higher in Nordic countries: for instance in 2007, broadband cost in Norway and Iceland are among the highest in OECD countries (OECD, 2007). In term of human capital formation and e-skills building, the quality of math and science education is well below the average of the ‘NRI top ten’, except for Finland.

The Nordics Achilles’ heel is a combination of high taxes, cumbersome administration, expensive communications and limited e-skills

Staying the course ?

Issues and Challenges for the Future of E-Readiness in the Nordic Countries

From the analysis carried above, a few key messages emerge, including the following:

- The strong show of Nordic Countries in terms of e-readiness will not disintegrate overnight. The fundamentals on which it was built (strong IT infrastructure, high level of general education, technology and knowledge focus) are firmly embedded in national policies and societal behaviors.
- However, some differences among Nordic Economies – and even more so between Nordic Economies and those of other e-readiness top players – point at a few weaknesses or handicaps which might diminish their performance and comparative advantages in the years to come.
- The areas in which the most urgent efforts are required include (1) the market environment, (2) human resources, and (3) government usage.

Nordic market environments can be improved

When comparing the Nordic countries on one hand, and other e-readiness champions on the other (see above), indicators linked to the 'market environment' were the ones for which differences were the most striking between the two groups, and to the disadvantage of the former.

High levels of taxation, limited use of foreign technology licensing, as well as existing commercial and contractual procedures, have been weighing on the NRI performance of Nordic countries.

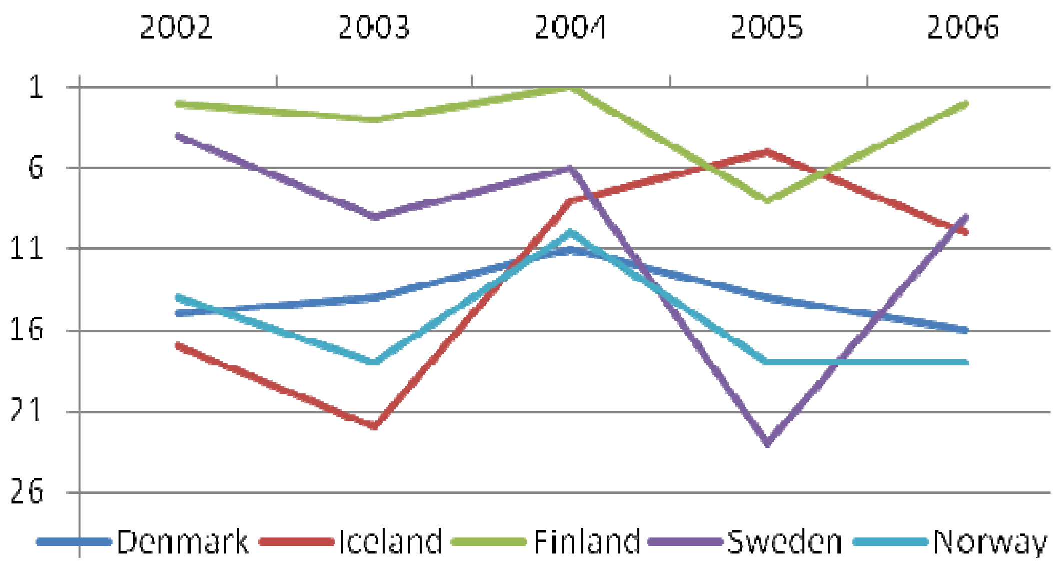


Figure 8 : Nordic Countries' Market Environment sub-index rankings

In the global race to select better locations for growing a business, the high levels of corporate taxation prevailing in Nordic countries could prove a growing handicap. In the same fashion, the complexity of procedures imposed on local and foreign companies to start or develop operations is being felt as more punitive in a sector like ICTs, where agility and ability to seize opportunities quickly are becoming more vital. This is of particular importance for small- and medium-sized enterprises (SMEs), which will have a growing role to play in generating new jobs in Nordic economies[6].

[6] Differences in labour market institutions and practices are substantial in Nordic countries, particularly as regards the role of the state in collective bargaining and conflict resolution. It has remained strong in Denmark and Norway (and Finland, through income policy), whereas Swedish labour markets stayed largely free from state intervention. Strong instruments for conflict resolution exist in Denmark and Norway; Sweden enjoys a relatively high level of social partner responsibility for outcome bargaining; quasi-continuous tripartite consultation play a stabilizing role in the more turbulent political environment of Finland.

Nordic countries show low levels of foreign technology licensing, indicating that foreign firms have limited capacity to manufacture and sell products in the Nordic area. In such a domain, a more competitive environment could help diversify the services provided to consumers while reducing their prices, and to improve the level or sector revenues. Compared to other OECD countries, Nordic economies suffer from a significant opportunity gap in this respect.

	2000	2005	CAGR (2000-2005)	GDP/cap US$
Denmark	2.61	2.54	-2.76%	47,732
Finland	3.3	2.7	-22.22%	37,454
Iceland	2.93	2.89	-1.38%	54,322
Norway	1.62	1.63	0.61%	63,961
Sweden	2.84	2.8	-1.43%	39,591
Italy	2.24	2.55	12.16%	30,267
Netherlands	2.65	2.22	-19.37%	38,739
Poland	3.46	3.79	8.71%	7,920
Slovak Republic	4.46	4.28	-4.21%	8,803
Switzerland	3.5	3.54	1.13%	48,590
Turkey	3.12	3.41	8.50%	5,045
United Kingdom	2.1	2.18	3.67%	36,971
United States	3.28	2.9	-13.10%	41,789

Source : Authors, from OECD 2006 data

Figure 9 : Share of electronic communication revenues as a %of GDP

From 2000 to 2005, the Nordic countries have experienced decreases in the share of electronic communications revenues as a percentage of GDP. In terms of competition, the specific local environment of the electronic communications market shows a predominance of incumbent operators[7]. This is correlated to the persistent high cost of services, ranging from residential and business telephone subscriptions to that of cellular phone calls and broadband, the fastest growing segment after (and in conjunction with) the mobile segment.

[7] For instance, in the context of its 2002 Electronic Communications Framework Directive (2002/21/EC), the European Commission identified a lack of competition in Finland, and exerted its veto power against Ficora, the Finnish regulator. The Norwegian Government, who still owns 53.7% of Telenor ASA, has introduced also a foreign ownership restriction, guaranteeing a minimum of 34% Government ownership. Iceland domestic fixed and mobile operators (Siminn and Og Vodafone) have put restrictions on the fixed to mobile termination rates, significantly enhancing their market power on the mobile and interconnection markets.

Over the recent past, Nordic Governments have undertaken reforms to improve some aspects of their market environment[8]. Such efforts will need to be enhanced and consolidated.

E-skills are not growing as fast as they should

Improving Nordic citizen's ICT skills is perceived locally as a priority, as witnessed by the establishment in 2006 of a shared Nordic framework in the area of ICT in education (E-learning Nordic 2006). That framework was used for assessing the position of the Nordic countries, in relation to one another. Denmark's 2007 ICT Policy report states that "an overall plan on how to improve the Danes' general ICT skills will be presented in 2007'. The Danish ICT Council will be discussing research and innovation within ICT, and how broadband may be used and applied in the best possible way.

[8] For example, a 2007 Danish law provides measures for creditor and judicial monitoring of trustees' work, and institutes financial incentives for trustees to conduct insolvency proceedings more efficiently. Recently, Finland reduced the minimum share capital for starting a business from € 8.000 to €2.500, and simplified documentation requirements. Iceland and Norway have reformed the legislation protecting investors. Iceland extended requirements for immediate and annual disclosure to all non listed public corporations. Immediate and detailed disclosures to the public are required and governing rules for boards have been introduced. Norway expanded the regulation and definition of related-party transactions that shareholders must approve, strengthening existing protections.

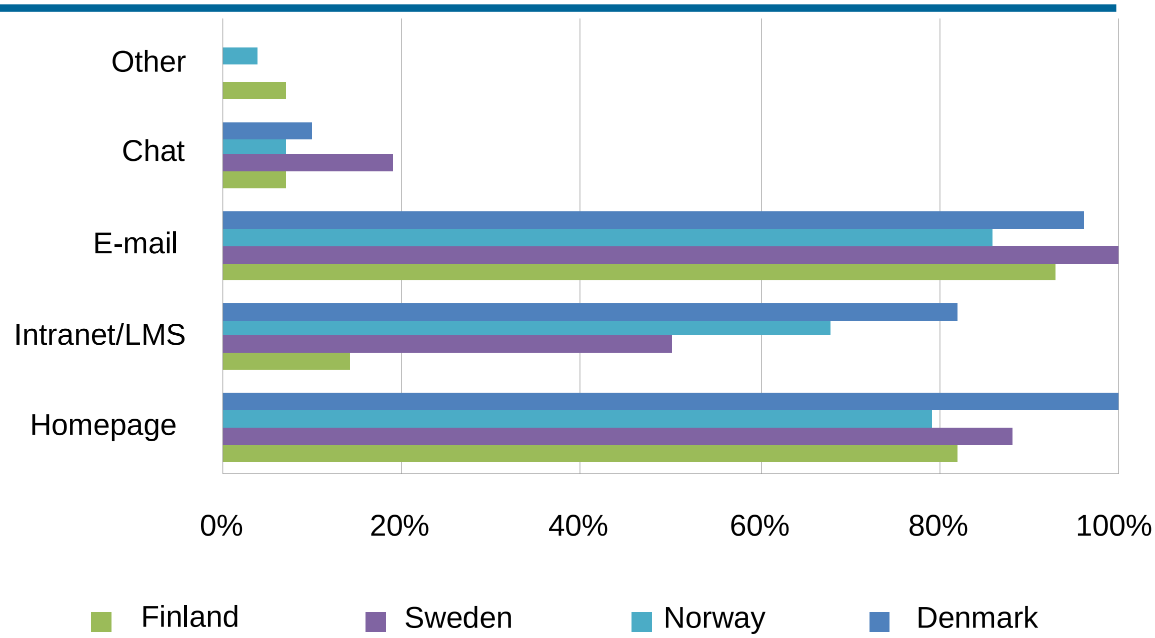


Figure 10: Technologies used in Nordic schools (2006)

E-learning Nordic 2006 shows that ICT has a positive impact on the schools' overall target – improving pupils' learning. However, the study also shows that the full potential of ICT is not being fully realized in many schools, as usage may vary (see chart above). Teachers are mostly focused on using ICT to support subject content. Still, a positive impact of ICT on teaching is also seen on pupil engagement, differentiation, creativity and more efficient use of time. Another highlight of the study is that the use of ICT as an organizational tool has not yet fully matured. The preconditions for using ICT for knowledge sharing, communication and school-home co-operation are at hand, and ICT is indeed being used with such objectives in many schools, but impact so far as been moderate at best.

As Europe as a whole braces for a significant lack of e-skills at all levels (producers, users, practitioners), the Nordic countries may be the first to 'feel the pinch', as insufficient e-skills may affect their e-readiness ranking in the next few years

As Europe as a whole braces for a significant lack of e-skills at all levels (producers, practitioners, users), the Nordic countries may be the first to 'feel the pinch', as insufficient e-skills may affect their e-readiness ranking in the next few years.

When asked about what steps should the Nordic key players take in order to ensure a bright future for Nordic ICT, a senior executive at the Technical Research Centre of Finland answered mentioning six important steps: "*There should be created Nordic SME-based competence clusters, together with converging technological niche platforms. The utilization of mobile ICT infrastructures to include remote monitoring should be enhanced. There should be an initiative for creating and integrating a Nordic test market for ICT applications and ICT policies in the health sector. There should be a Nordic level research and policy initiative to develop new ICT-based concepts for information and general security. There is a need for an ideation and creation of new business models for user-driven application developments, and lastly, a Nordic initiative to enhance electronic business transactions and applications*".

A possible additional avenue for action in the Nordic countries : ICTs at the local level

Sub-national entities such as cities have often proved more dynamic than their own countries

One of the limitations of an index like NRI is that (as most analyses carried out on e-readiness, competitiveness or knowledge strategies) it relates exclusively to the national context. One of the reasons for this is of course the relative lack if data for other economic contexts than that of nation states.

Yet, in an area like e-readiness, the most radical and impactful changes may be happening at other levels. For example, recent studies[9] have shown that in areas like e-government, sub-national entities such as cities have often proved more dynamic than their own countries.

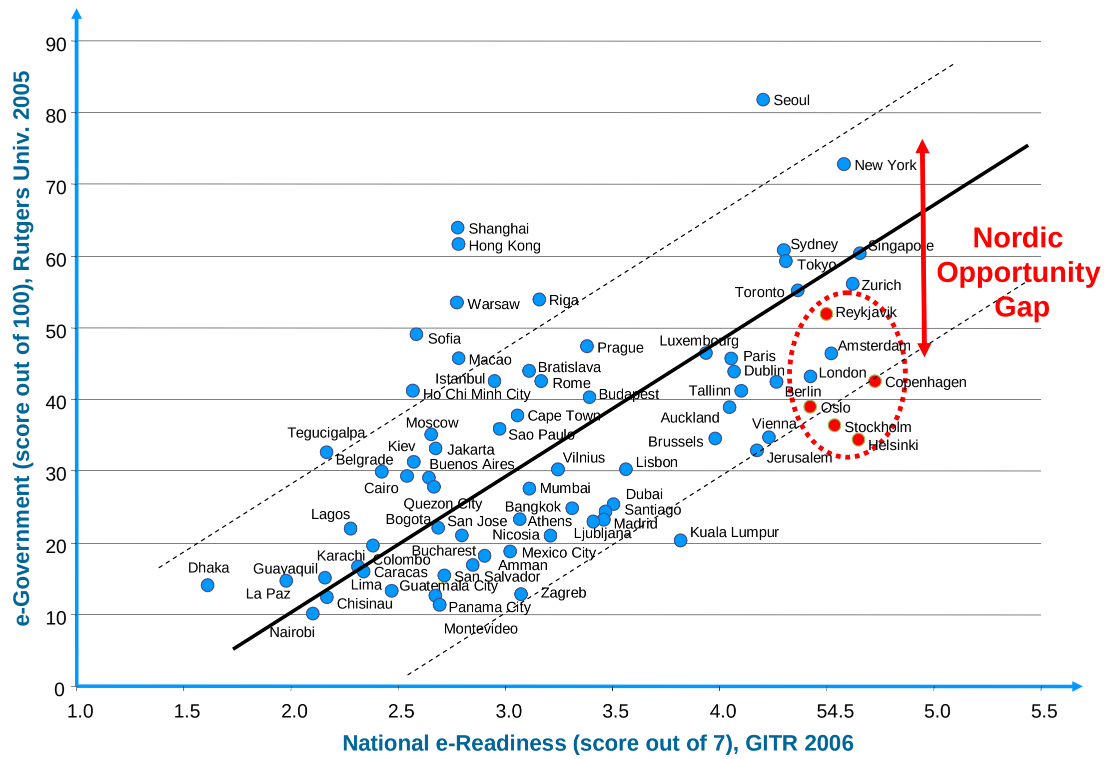
To some extent, one may consider that the local level often acts as a laboratory for the rest of the national economy: if one particular approach proves successful, it is likely to expand rapidly to the rest of the national territory.

If this is true, a country in which cities prove dynamic adopters of technology by being more 'network ready' than the average of the nation is likely to improve its e-readiness scoring in the future. Conversely, a country in which local e-readiness performance tends to lag behind national e-readiness performance is likely to suffer from a relative decrease in its overall NRI ranking in the years to come.

It is hence of particular interest to assess how the cities of Nordic countries have been performing in this respect.

9 For example Lanvin and Lewin (2007)

The following diagram shows how a certain number of cities rank in terms of e-government usage (vertical axis) vs the overall NRI score of the countries in which they are situated (horizontal axis). In such a diagram, a point above ‘parity level’ (i.e. above the black diagonal running through the center of the cloud of points) corresponds to a city which is outperforming its own country. On the contrary, a point below that diagonal describes the opposite situation.



<u>Sources</u> : WEF/INSEAD (NRI/GITR), Rudgers-SKKU (e-Governance) and authors’ caculations

Figure 11 : Nordic Countries vs Nordic Cities

When projecting on this diagram the values corresponding to the capital cities of the five Nordic countries, one obtains a striking picture. On one hand, all five cities (Reykjavik, Stockholm, Helsinki, Copenhagen and Oslo) are very much grouped together, mirroring the herd behavior witnessed before for Nordic countries.

On the other hand, all of those cities are significantly below the parity diagonal, indicating a significant and consistent opportunity gap across this group of countries. National policies regarding ICT (and e-readiness in general) are not being strengthened as much as they could by local (especially municipal) initiatives.

This situation contains both a threat and its possible antidote. On one hand, if no action is taken at the local level (and proper incentives or signals provided at the national level), the future e-readiness performance of Nordic countries may be hampered by a lack of innovation and lags in the adoption of global best practices (e.g. in e-government). On the other hand, one may consider that the current situation is one in which local decision makers such as mayors have a significant range of opportunities at hand to bring even more information- and knowledge-based benefits to their citizens.

Local decision makers such as mayors have a significant range of opportunities at hand to bring even more information- and knowledge-based benefits to their citizens

The next few years will tell whether Nordic cities can prove as forward looking, dynamic, innovative (and successful) as their respective nations have been over the last decade.

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By working at reducing their emerging weaknesses and remaining handicaps, Nordic countries will increase their ability to make the best out of their long-standing strengths (including in scientific education, political stability, social cohesion and environmental respect).

To a large extent, recent measures adopted in Nordic Countries show that the challenges identified above have been perceived, and have started to be addressed. Such efforts will need to be actively pursued (and possibly coordinated) to ensure that the Northern Stars keep illuminating the skies of e-readiness, and remain a point of reference for all those wandering the unchartered waters of the global knowledge economy.

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