
Digital divide in Europe: assessing and comparing the e-readiness of a developed and an emerging economy in the Nordic region

Princely Ifinedo*

Department of Computer Science and Information Systems
P. O. Box 35, Mattilanniemi, Building Agora
University of Jyväskylä, Finland
Fax: (+358) 14 260 3011 E-mail: premifin@cc.jyu.fi
*Corresponding author

Reggie Davidrajuh

School of Science and Technology
Stavanger University College
P. O. Box 2557, Ullandhaug
N-4091 Stavanger, Norway
Fax: (+47) 51 83 17 50 E-mail: reggie.davidrajuh@tn.his.no

Abstract: This paper discusses the *digital divide* in the Nordic region of Europe by comparing the e-readiness of Norway and Estonia. The e-readiness of both countries is above the average score; Norway, however, is better than Estonia. In general, e-readiness was used solely to quantify any divide for both countries.

Keywords: digital divide; e-readiness; networked economy; Norway; Estonia; Nordic.

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Biographical notes: Princely Ifinedo is doctoral candidate and Researcher at the Department of Information Systems Science at the University of Jyväskylä, Finland. He holds an MBA in International Management from Royal Holloway, University of London, a MSc (Eng) in Informatics from Tallinn Technical University, Estonia and a bachelor's degree in Mathematics/Computer Science from the University of Port-Harcourt, Nigeria. He has taught various IS/IT courses including e-commerce strategy and project management. His current research interests include e-government, ERP implementations, ISD risk management and IS/IT diffusion in developing countries. He is a member of ACM, AIS, AOM and IEEE.

Dr. Reggie Davidrajuh received a master's degree in Control Systems Engineering in 1994 and a PhD in Industrial Engineering in 2001, both from the Norwegian University of Science and Technology (NTNU). He is currently Associate Professor of Computer Science at the Department of Electrical and Computer Engineering at University of Stavanger, Norway. His current research interests include e-commerce, agile virtual enterprises, discrete event systems and modelling of distributed information systems.

1 Introduction

This notion of the *digital divide* has been realised by The World Bank and several other entities as a barrier to socioeconomic development across many emerging nations (WSIS, 2004; InfoDev, 2004). It clearly sprouts from the advent of the Information Age, which is akin to a global wave sweeping through all corners of the world. Albeit unevenly, richer and developed countries tend to be more in the pathway of this tsunami of change than their poorer and less developed counterparts (Molla, 2000). The term *digital divide* is used to connote such differing standards or imbalances; sadly though, it may also exist within the confines of one single nation (WSIS, 2004; InfoDev, 2004; Yu and Wang, 2004). Notwithstanding, the Information Age is bringing about gradual, yet remarkable shifts in our global society, in the sense that more and more nations are shifting away from erstwhile agrarian and industrial economies to one that is knowledge-based (Neff, 1998) or the network economy (Hart, 2003), information economy (Castells, 1999), e-economy (Turner, 2001) and so on.

That said, several national governments (InfoDev, 2004; Davidrajuh, 2004b; Kalkun and Kalvet, 2002; Joi, 2004; Ifinedo, 2004) have policies and programmes in place aimed at curbing the negative impacts of the *digital divide* within their countries. In particular, many such governments across the globe have resorted to instituting e-government initiatives (InfoDev, 2004; Yu and Wang, 2004; Joi, 2004; Ifinedo, 2004; Davidrajuh, 2004a) as a way of better positioning themselves in the Information Age (Neff, 1998; Hart, 2003; Castells, 1999; Turner, 2001), or at the least seen to be showing commitments in redressing the imbalances resulting from the low utilisation of knowledge resource and Information Communication and Technologies (ICT) in the economy and governance (Yu and Wang, 2004; Kalkun and Kalvet, 2002; Joi, 2004; Ifinedo, 2004; Davidrajuh, 2004a; Metaxiotis and Psarras, 2004; Sharma, 2004). In that regard, it is worthwhile to have some understanding of the level of preparedness of nations vis-à-vis their performances on key items or indicators for assessing the notion of the *digital divide* among nations (Bui *et al.*, 2002). For this reasoning, several authors have collected data regarding ICT use and diffusion and other socioeconomic factors, which are analysed with the intent to computing e-readiness and competitiveness scores across nations (for example, see Davidrajuh, 2004a; Bui *et al.*, 2003). Essentially, e-readiness is used to capture how nations fare in terms of adopting and using the various components of a networked economy (The Bridges Organization, 2001), a poor score may suggest the presence of the *digital divide*.

1.1 The tools for measuring e-readiness

Apparently, the various bodies and organisations that produce tools for measuring e-readiness do so by using differing parameters, which are classified under a number of categories such as infrastructure, access, applications and services, economy, use of the internet (in business, government, homes), promotion and facilitation (industry-led standards), skills and human resources (ICT education, workforce, e-business climate (competition, political and financial stability, foreign investment, financial infrastructure, pervasiveness per capita usage) and so on. Fundamentally, the *digital divide* is often described in terms of the above-mentioned parameters or indicators.

The Bridges Organization (2001) provides a comprehensive coverage on many of the tools and their sources. Some of the organisations that have tools or models for measuring e-readiness of nations include The Center for International Development at Harvard University, The Asia Pacific Economic Cooperation (APEC) Electronic Commerce Steering Group, McConnell International, The World Information Technology and Services Alliance (WITSA). In the same vein, researchers have also attempted to compare the various tools and models; see for example, (The Bridges Organization, 2001; Al-Solbi and Mayhew, 2003). More importantly, a nation's level of e-readiness may not be fully represented easily in these indices for a variety of reasons – reliability, availability and completeness of data (Al-Solbi and Mayhew, 2003). However, such indices provide nations with the opportunity to evaluate their performances against set objectives in development plans or evaluate their efforts in stemming any digital divide (Yu and Wang, 2004; Kalkun and Kalvet, 2002; Joi, 2004). Further, the level of preparedness or integration within the global networked economy could be assessed for a country, not forgetting healthy rivalry among nations that want to emulate better-performing nations (Bui *et al.*, 2003). The World Bank's reports and publications (KAM, 2002) on some of the indicators certainly engenders this philosophy. Additionally, less-endowed nations may benchmark their progress and performances against the best performing nations. This paper is set against that background as it sets out to compare the e-readiness of two Nordic nations – Norway and Estonia – sharing similar cultures and are closely linked in international trade and cooperation. The primary justification for the study hinges on the fact that western Europe (including Norway) has occupied an enviable position(s) in comparison to other parts of the world regarding integrating within the networked world; thus, the notion of the *digital divide* for Norway is minimal (WSIS, 2004; EIU, 2004; World Economic Forum, 2004). In contrast, Estonia, an emerging economy in the Nordic region, may not have the same facilities as Norway. Albeit, Estonia is reported to lead the rest of Eastern Europe (World Economic Forum, 2004) in terms of its readiness for the networked or digital economy, it remains to be seen how it compares with a developed nation from the region. Hence, the question we seek to answer is this: Do the two countries' e-readiness compare? Or, do they differ markedly to suggest the *digital divide* in the Nordic region of Europe using the two countries as exemplars.

In the paper, we will be looking to establish if there is the *digital divide* in the Nordic region by using a variety of e-readiness indicators for Norway and Estonia. Definitively, e-readiness measure is used to visualise any differences. Interestingly, some studies and data over time seem to suggest convergence in some selected key indicators for assessing readiness in a networked world for developing/emerging economies and developed economies (Dutta *et al.*, 2004). The thrust of this paper is to investigate such for one region of Europe, which is hoped, would help us to answer our question. Also, the convergence reported in regard of network readiness of economically differing nations (Dutta *et al.*, 2004) could be assessed from this effort.

The rest of the paper is organised thus: Section 2 presents the background information of Norway and Estonia and the reasons why the comparisons may be useful. Section 3 introduces the e-readiness tool used for comparing the two countries. In Section 4 the e-readiness of the countries is assessed and compared. In this section, upon highlighting

areas of strengths and weaknesses, a succinct recommendation for each country, is provided. Finally, concluding remarks is made about the issue of the *digital divide* for the two countries.

2 Background information on Norway and Estonia

Norway is a high-income Nordic country – industrialised and developed whilst Estonia is an upper middle income emerging economy of Eastern Europe (World Bank Organization, 2004a; World Factbook, 2004). Norway and Estonia have a history that dates back to the Middle age when cities in the two countries were a part of the Hansaetic League – a commercial alliance that linked most northern European countries (MSN Encarta, 2004). And, at point in history both Estonia and Norway were a part of the Kingdom of Sweden. Recently, Estonian main trading partners have been the Nordic countries such as Finland, Sweden and Norway (World Factbook, 2004; Tiits *et al.*, 2003). Similarly, most of Estonian Foreign Direct Investment (FDI) originates from the Nordic countries including Norway (Kalvet, 2004). There are various cooperative arrangements between the two countries, some of those cover education, culture, knowledge transfer, science and so on. On issues relating to Information Communication and Technology (ICT) both countries regularly partake in cooperation between the Scandinavian and Baltic states; see for example (International Northern eDimension, 2002). The need to compare the e-readiness of the two countries is informed by the reasoning that there is an increasing cooperation between the Baltic countries – to which Estonia belongs – and the Scandinavian countries including Norway on several fronts (economical, social, technological, educational and so on). The two regions are sometimes referred to as Nordic. In short, this rising levels of regional cooperation is helping to accelerate the ‘networked economies’ of the Nordic region (Tiits *et al.*, 2003; Kalvet *et al.*, 2000). In this regard, presenting a picture through the comparisons of the e-readiness of exemplars nations in the regions: Estonia, a Baltic and emerging economy and Norway, a Nordic and developed country may shed some light on areas where improvements in cooperation could be enhanced as countries seek to bridge any *digital divide* in the region (Kalkun and Kalvet, 2002). Culturally, Estonia and Norway share similar orientations. Using the Hofstede’s (2001) cross-cultural differences typology, Norway and Estonia share similar characteristics (Mockaitis, 2002).

3 Tool for measuring e-readiness

As was mentioned, there are several tools available for measuring the e-readiness of a particular country. In fact, different countries tend to use tools, guides and/or measures to assess their preparedness and competitiveness in the emerging networked world. For example, one report of India’s e-readiness measure utilised a version that is appropriate for the task of assessing development in its states (India E-readiness Report, 2003). Further, there is a publication that reports e-readiness in Estonia in which items pertaining to the ‘network society’ are reported (Kalvet, 2002). Similarly, the e-readiness of Norway has been discussed previously by one of the co-authors (Davidrajuh, 2004a) in which three basic building blocks relating to the following were used:

- 1 demand forces
- 2 supply forces
- 3 societal infrastructure.

The tool used by Davidrajuh (2004a) would be used in comparing the two countries in so far as it affords us the advantage of uniform comparison. Moreover, it is chosen because it is easily extensible, is easy to use and has a large set of indicators that covers most of the measures in similar tools (Bui *et al.*, 2003; The Bridges Organization, 2001). Importantly, a majority of the e-readiness tools are not as extensive in their composition, some are not easy to use and others are not readily available (Bui *et al.*, 2002; 2003; The Bridges Organization, 2001). The argument put forward by Bui *et al.* (2003) is that it is a challenge to present a comprehensive model that encompasses all the driving forces of an economy with respect to its e-readiness. One of the most robust e-readiness tools includes those by the World Bank (KAM, 2002) and the Economist Intelligence Unit (EIU, 2004) that covers seven building blocks each. Suffice to say that some of the e-readiness tools tend to describe and measure the same metrics using different names. In brief, the tool used in this paper is developed by Bui *et al.* (2002; 2003), and it has been validated. It consists of three basic building blocks, see Figure 1. The three basic building blocks are divided into eight major factors, and each of these major factors has a set of indicators. The major factors and the number of indicators that come under these factors are given below:

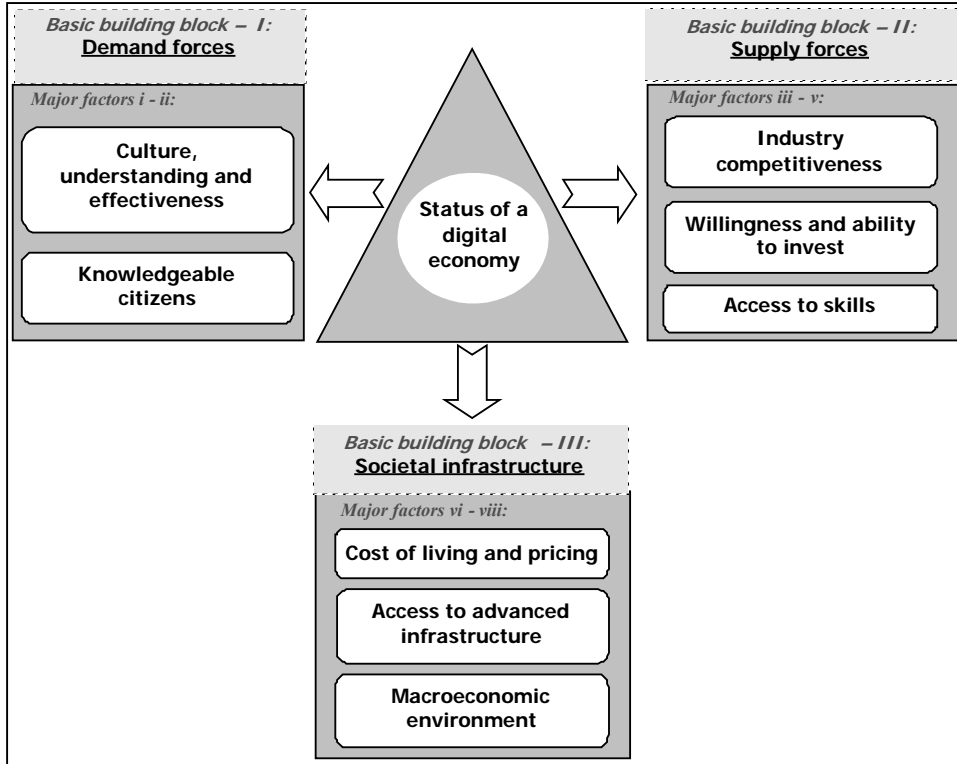
- I Demand forces
 - i Culture, understanding and effectiveness: four indicators
 - ii Knowledgeable citizens: six indicators
- II Supply forces
 - iii Industry competitiveness: seven indicators
 - iv Access to skilled workforce: six indicators
 - v Willingness and ability to invest: four indicators
- III Societal Infrastructure
 - vi Cost of living and pricing: three indicators
 - vii Access to advanced infrastructure: ten indicators
 - viii Macroeconomic environment: 12 indicators.

The tool uses a total of 52 indicators. In measuring the e-readiness, all 52 indicators (e_i) are assigned values on a 1–5 scale (1, the worst score; 5, the best score). Then e-readiness of a country is calculated by a simple Figure-of-Merit (FOM) calculation. In this calculation, all the indicator values are multiplied with corresponding weights and summed.

Thus:

$$E-readiness = \frac{\sum_{i=1}^{52} IWeight_i \times e_i}{\sum_{i=1}^{52} IWeight_i}$$

Figure 1 Components of the e-readiness measuring tool provided by Bui *et al.* (2002)



4 E-readiness of Norway and Estonia

In this section, all the 52 indicators are evaluated for Estonia and Norway in a tabular form for readability purposes. Also, it must be noted that the proportionality constant (simple proportions) would be applied in normalising indicators to fit a five-point interval scale. For example, if an indicator, say human development index from its source (Human Development Report Indicators, 2003) for two countries, Canada and Nigeria are rated 0.93 and 0.46, respectively from a maximum score of 1. On our five-point interval scale that would be 4.65 and 2.3, respectively, for those countries.

4.1 Measuring the demand forces

There are two Major Factors (MF) under this block.

4.1.1 MF-1: Culture, understanding and effectiveness

Indicator-1 (e_1): National culture is open to foreign influence

Here, on a 1–10 scale, Norway and Estonia scored 5.81 and 7.77, respectively (World Competitive Yearbook, 2001). This is not surprising in light of the summary made by the IMD's report: "... and Central Europe, emerge as world competitors in their own right. They will brutally assail the competitiveness of the USA and Europe, as Japan did over the past decades."

| Indicator | Norway | Estonia |
|-----------|--------|---------|
| e_1 | 2.9 | 3.9 |

Indicator-2 (e_2): English language usage

There is data available on English language usage in Norway. However, from the descriptions given in (VOX, 2003), an average score is assigned to Norway (Davidrajuh, 2004a). Similarly, from the reports made public by the TEMPUS CME on the accreditation of IT High Education in Estonia (Tempus, 1997), the score of 1.5 (half that of Norway) is deemed appropriate. The publication reads 'Inviting foreign experts is complicated *e.g.*, the self-evaluations are written in Estonian language, need translation. On the other hand our [Estonian] language law does not allow to demand the self-evaluations only in a foreign language *e.g.*, English.' Years under the Soviet Union may not have helped matters for Estonia.

| Indicator | Norway | Estonia |
|-----------|--------|---------|
| e_2 | 3 | 1.5 |

Indicator-3 (e_3): Percentage of urban population

Urban population in Norway and Estonia was 74% in 1998 (World Bank, 2001), USA had a similar value (77%).

| Indicator | Norway | Estonia |
|-----------|--------|---------|
| e_3 | 5 | 5 |

Indicator-4 (e_4): Percentage of population 65 years or older

The percentage of over 65 years for Norway and Estonia in 2002 is 15% (same value). Japan has among the highest in the world at 18.1% and most of the countries in Sub-Saharan Africa hover around 2–3% (World Bank Organization, 2004b).

| Indicator | Norway | Estonia |
|-----------|--------|---------|
| e_4 | 4.5 | 4.5 |

4.1.2 MF-2: Knowledgeable citizens

Indicator-5 (e_5): Adult literacy rate

Norway and Estonia score very high here (above 99%) for each of the countries (World Factbook, 2004).

| Indicator | Norway | Estonia |
|-----------|--------|---------|
| e_5 | 5 | 5 |

Indicator-6 (e_6): Secondary enrolment

According to the Statistical Information Management and Analysis (SIMA, 2003) database, Norway has 121 point in 1998 and Estonia has 104 points.

| Indicator | Norway | Estonia |
|-----------|--------|---------|
| e_6 | 5 | 4 |

Indicator-7 (e_7): Tertiary enrolment

Tertiary enrolment rate for Norway is 64% as per World Bank (2001; World Development Indicators, 2001) data; the rate for Estonia is 48%; Canada has 90% (among the highest in the world).

| Indicator | Norway | Estonia |
|-----------|--------|---------|
| e_7 | 3.6 | 2.7 |

Indicator-8 (e_8): 8th grade achievement in science

No data is available for this indicator for the two countries. However, if one takes the Norwegian Education Minister's viewpoints that Norwegian students perform below the international average in mathematics and science (Teaching Natural Sciences, 1999), "a value of three is justifiable" (Davidrajuh, 2004a). Interestingly, the scores of Slovakia Republic and Slovenia for science are computed at 535 and 533, respectively. On the same scale, Chinese Taipei came out top with 569. Several studies have shown that Estonia performs as much as any of the Central and Eastern European countries on related issues (Kalvet *et al.*, 2000). Thus, a score of four would be justifiable if one goes by the scores for the two Central and European countries.

| Indicator | Norway | Estonia |
|-----------|--------|---------|
| e_8 | 3 | 4 |

Indicator-9 (e_9): MGMT education available in first class business schools

According to the Global Competitiveness Report (2001) both countries had 5.4 and 4.9 on 1–7 scale.

| Indicator | Norway | Estonia |
|-----------|--------|---------|
| e_9 | 3.9 | 3.4 |

Indicator-10 (e₁₀): Flexibility of people to adapt to new challenges

World Competitiveness Yearbook (2001) gave 5.18 points to Norway and 7.60 to Estonia on a 1–10 scale.

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₁₀ | 2.6 | 3.8 |

4.2 Measuring the supply forces

There are three Major Factors (MF) under this block.

*4.2.1 MF-3: Industry competitiveness**Indicator-11: Technology Achievement Index (TAI)*

The TAI value for Norway was 0.579, whereas Finland got the highest rating 0.744 (TAI, 2001). There is no available data for Estonia. Once again, we use data from a comparable emerging economy as a proxy; namely, Slovenia scored 0.458.

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₁₁ | 3.9 | 3 |

Indicator-12 (e₁₂): Gross tertiary science and engineering enrolment ratio

Norway has produced 16 reports per million inhabitants. Korea has the highest value for this indicator – 22 reports per million inhabitants (KAM, 2002).

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₁₂ | 3.6 | 2.5 |

Indicator-13 (e₁₃): Administrative burden for start-ups

On the Global Competitiveness Report, with a scale of 1–7, Norway received 5.10 and Estonia got 5.80 (World Economic Forum, 2004).

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₁₃ | 3.6 | 4.1 |

Indicator-14 (e₁₄): Patent applications granted by the USPTO 2000 (per million population)

USA leads with 5.86, whereas Norway's score is 4.21 and Estonia has a disappointing value of 0.10 (KAM, 2002).

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₁₄ | 3.6 | 0.09 |

Indicator-15 (e₁₅): Indicator-15 – private sector spending on R&D

On a 1–7 scale, Global Competitiveness Report Norway and Estonia have 4.4 and 3.7, respectively (World Economic Forum, 2004).

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₁₅ | 3.1 | 2.6 |

Indicator-16 (e₁₆): Total expenditure for R&D as % GNI (Gross National Income)

Norway and Estonia use 1.58% and 0.57% of GNI for R&D respectively. The Norwegian value is about 2% less than that of Sweden – the world leader in this category (World Development Indicators, 2001).

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₁₆ | 2.1 | 0.76 |

Indicator-17 (e₁₇): High-tech exports as percentage of manufactured exports

Norway high-tech export is 17% of its total exports; the Estonia figure is 13%. For Singapore, which is among the world' best, it is 61% (World Development Indicators, 2001).

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₁₇ | 2 | 1.5 |

*4.2.2 MF-4: Access to skilled workforce**Indicator-18 (e₁₈): Public spending on education as percentage of GDP*

Citing again World Development Indicators (EIU, 2004), Norway has the highest spending (6.8%) on education as a percentage of GDP. Estonia spends 6.2%.

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₁₈ | 5 | 4.6 |

Indicator-19 (e₁₉): University education meets the needs of economy

On a 1–10 scale, World Competitiveness Yearbook (2001) gave 5.22 points to Norway and 5.90 to Estonia.

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₁₉ | 2.6 | 3 |

Indicator-20 (e₂₀): Indicator-20 – well-educated people do not emigrate abroad

On a 1–10 scale, World Competitiveness Yearbook (2001) gave 7.70 points to Norway and 5.37 to Estonia.

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₂₀ | 3.9 | 2.9 |

Indicator-21 (e₂₁): Extent of staff training

On a 1–10 scale, World Competitiveness Yearbook (2001) gave 5.4 points to Norway and 4.50 to Estonia.

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₂₁ | 2.7 | 2.3 |

Indicator-22 (e₂₂): Research collaboration between companies and universities

On a 1–10 scale, World Competitiveness Yearbook (2001) gave 4.6 points to Norway and Estonia got 4.10.

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₂₂ | 2.3 | 2.1 |

Indicator-23 (e₂₃): Number of technical papers per million people

Sweden has the highest papers per million (6.82). Norway takes a close second place with 6.44; Estonia has 5.41 (KAM, 2002).

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₂₃ | 5 | 4 |

*4.2.3 MF-5: Investment**Indicator-24 (e₂₄): Composite ICRG risk rating*

The International Country Risk Guide (The International Country Risk Guide, 2000a) gave 90.5% (low risk) to Norway and comparable data for Estonia.

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₂₄ | 4.5 | 4 |

Indicator-25 (e₂₅): Availability of venture capital

Norway received 4.5 points on a 1–7 scale; Estonia got 3.5 (World Economic Forum, 2004).

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₂₅ | 3.2 | 2.5 |

Indicator-26 (e₂₆): Entrepreneurship among managers

World Competitiveness Yearbook (World Economic Forum, 2004) awards 5.19 points to Norway on a 1–10 scale. Estonia received 6.83.

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₂₆ | 2.6 | 3.4 |

Indicator-27: Foreign direct investment as percentage of GDP

FDI in Norway was 1.15%; Singapore has the highest FDI, which is 9.34% of its GDP (SIMA, 2003). Davidrajuh, (2004a) rated Norway 1.5 on a scale of 1–5. The reports by (Tiits *et al.*, 2003; World Competitive Yearbook, 2001) indicate a sizeable inflow of FDI into Estonia. The World Bank (2001) records for Estonia put the GDP and FDI at 5.2 billion and 305 million, respectively. Thus, a moderate score of three would be acceptable.

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₂₇ | 1.5 | 3 |

4.3 Measuring the societal infrastructure

There are three major factors under this block.

*4.3.1 MF-6: Cost of living and pricing**Indicator-28 (e₂₈): International Cost of Living (COL) based on \$US100*

Tokyo, Japan is the most expensive place to live in and Athens, Greece is least of the 50 most expensive cities in the world. Norway's COL is rated with an index 96.2 for Oslo (International Country Risk Guide, 2000b). No Estonian city was listed on this index.

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₂₈ | 3.7 | 5 |

Indicator-29 (e₂₉): Inflation rate – CPI in percentage

Currently, Norway endures a rate of 1%; this indicates a strong economy. Among the other best performing countries are Estonia and Sweden, both with 1.5% (World Factbook, 2004; SIMA, 2003). However, there is indication that since joining the EU, inflation rate is rising in the country; see for example, (World-News Watch, 2004b).

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₂₉ | 5 | 3 |

Indicator-30 (e₃₀): GDP per capita (PPP) in US dollars

Norway has one of the highest GDP per capita, currently \$US36,000 and Estonia has \$US12,300 (World Factbook, 2004; World Development Indicators, 2001).

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₃₀ | 5 | 3 |

*4.3.2 MF-7: Advanced infrastructure**Indicator-31(e₃₁): Telephone per 100 people (Teledensity)*

In 2003, Norway and Estonia received 157.80 and 100.07, respectively, for teledensity by the International Telecommunication Union (ITU, 2004).

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₃₁ | 5 | 4 |

Indicator-32 (e₃₂): Mobile phones per 100 people

For the year 2003, Norway and Estonia got 90.89 and 65, respectively (ITU, 2004).

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₃₂ | 4.5 | 3.6 |

Indicator-33 (e₃₃): Computers (PCs) per 100 people

Norway and Estonia received 52.83 and 21.03 (ITU, 2004). These values were in fact among the highest in the world.

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₃₃ | 5 | 3 |

Indicator-34 (e₃₄): Internet hosts per 10,000 people

Using the ITU (2004), Norway has 5026.08 and Estonia has 3276.75. The world's average is 1107.08.

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₃₄ | 5 | 3.5 |

Indicator-35 (e₃₅): International telecom, cost of call to the USA

It costs \$US5.85 to make a five-min call from Ascension Island to USA. From Norway, the cost is 0.30 cents and for Estonia it is about one dollar (Opex Communications, 2004).

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₃₅ | 4.7 | 3.8 |

Indicator-36 (e₃₆): Investment in Telecom as a percentage of GDP

Currently, China has the highest value (1.92%). Norway has 0.59% (World Competitive Yearbook, 2001). There is no data for Estonia in this database. However, according to Kalvet and colleagues (Kalvet, 2004), “Per capital IT spending is 150 EUR, which is higher than CEE (Central and Eastern Europe) average, but lower than the Western European average of 723 EU per capita”. In the IMD’s database (World Competitive Yearbook, 2001) Slovenia’s is 0.78%, which is higher than Norway’s.

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₃₆ | 2.2 | 2.9 |

Indicator-37 (e₃₇): Computer processing power as a percentage of worldwide MIPS (Million Instructions Per Second)

Norway’s computer processing power is 0.46% of worldwide MIPS. For USA, the value is 35% (KAM, 2002; World Competitive Yearbook, 2001). There is no available data for Estonia.

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₃₇ | 1 | 1 |

Indicator-38 (e₃₈): E-government

According to ASPA (2003), USA leads with a score of 3.11. On the other hand, Norway and Estonia got 2.55 and 2.01, which classifies them as ‘High E-gov Capacity’ countries.

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₃₈ | 4.1 | 3.2 |

Indicator-39 (e₃₉): ICT expenditure as a percentage of GDP

Norway spends 6.93% of its GDP on ICT. The highest expenditure under this category is by Singapore, which is 9% (World Development Indicators, 2001). Once again, the report by Kalvet *et al.* (Kalvet, 2004; Kalvet *et al.*, 2000), 2004 and the Slovenian’s, which is 7.17, in the database is used as a guide.

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₃₉ | 4 | 4.1 |

Indicator-40 (e₄₀): Freedom on the internet

The report Freedom House (2003) places Norway alongside Sweden and Finland as the leader in this aspect. Norway, Estonia and China score 9, 17 and 80 respectively.

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₄₀ | 5 | 4 |

4.3.3 MF-8: Macroeconomic environment
Indicator-41 (e₄₁): Trade as a percentage of GDP

Trade as percentage of GDP should be as low as possible. Rate for Norway is 77.1 and Estonia has almost twice that at 155 (World Development Indicators, 2001).

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₄₁ | 2 | 1 |

Indicator-42 (e₄₂): Adequacy of regulations and supervision of financial institutions

On a 1–10 scale, Norway was given 7.02 points and Estonia 7.47 (World Competitive Yearbook, 2001).

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₄₂ | 3.5 | 3.7 |

Indicator-43 (e₄₃): Protection of property rights

Heritage Foundation (2001) rates Norway ten and Estonia eight. China has four on this indicator.

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₄₃ | 5 | 4 |

Indicator-44 (e₄₄): Tariff and non-tariff barriers

On a 1–10 scale, Norway scored eight points. Hong Kong and Singapore scored ten points (World Competitive Yearbook, 2001). Estonia's value is slightly lower than that of Norway.

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₄₄ | 4 | 3 |

Indicator-45 (e₄₅): Soundness of banks

On a 1–7 scale, Norway and Estonia got 6.10 and 6.0, respectively (World Economic Forum, 2004).

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₄₄ | 4.4 | 4.4 |

Indicator-46 (e₄₆): Local competition

On a 1–7 scale, Norway received 5.50 points and Estonia's is 5.60 (World Economic Forum, 2004).

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₄₄ | 3.9 | 4 |

Indicator-47 (e₄₇): Regulatory framework

Singapore is on the top of the list with 1.82 points. Norway and Estonia scored 0.73 and 1.09, respectively (KAM, 2002).

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₄₇ | 2 | 3 |

Indicator-48 (e₄₈): Government effectiveness

Singapore is on the top of the list with 2.16 points. Norway scored 1.35 points (KAM, 2002); Estonia got 0.73. However, after joining the EU, perceptions have changed somewhat; see for example; World-News Watch (2004a).

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₄₈ | 3.1 | 2 |

Indicator-49 (e₄₉): Political stability

Finland is most politically stable (1.61 points). Norway was awarded 1.32 points. Estonia got 0.73 (KAM, 2002).

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₄₉ | 4.1 | 4 |

Indicator-50 (e₅₀): Press freedom

The Freedom House (2003) reports Norway on the top of the list. Estonia is scored 17 whereas Cuba and USA score 94 and 17, respectively.

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₅₀ | 5 | 4 |

Indicator-51 (e₅₁): Rule of law

Singapore is again on the top of the list with 1.85 points; Norway and Estonia scored 1.70 and 0.78, respectively (KAM, 2002). Events in Estonia such as joining the EU *etc.* may have changed this low value somewhat. A moderate score may be appropriate here.

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₅₁ | 4.6 | 3 |

Indicator-52 (e₅₂): Control of corruption

In 2003, Finland is the best performer on this index with 9.7; Norway scored 8.8, and Estonia came in with an average score of 5.5, Transparency International Corruption Perceptions Index (2003).

| <i>Indicator</i> | <i>Norway</i> | <i>Estonia</i> |
|------------------|---------------|----------------|
| e ₅₂ | 4.5 | 2.8 |

5 The e-readiness scores and discussion

Assuming equal weights of one for all the indicators, we summarise the e-readiness value for each major factor.

Table 1 The eight components of the e-readiness tool

| <i>Major Factors (MF)</i> | <i>Norway</i> | <i>Estonia</i> |
|---|---------------|----------------|
| MF-1: Culture, understanding, effectiveness: <i>emf_1</i> | 3.9 | 3.7 |
| MF-2: Knowledgeable citizens: <i>emf_2</i> | 3.3 | 3.5 |
| MF-3: Industry competitiveness: <i>emf_3</i> | 2.7 | 1.2 |
| MF-4: Access to skilled workforce: <i>emf_4</i> | 3.5 | 2.8 |
| MF-5: Willingness and ability to invest: <i>emf_5</i> | 3.0 | 3.2 |
| MF-6: Cost of living and pricing: <i>emf_6</i> | 4.6 | 3.6 |
| MF-7: Advanced infrastructure: <i>emf_7</i> | 3.5 | 3.1 |
| MF-8: Macro economic environment: <i>emf_8</i> | 4.6 | 3.4 |

The e-readiness values for Norway and Estonia for each building block is shown in Table 2 below:

Table 2 E-readiness of Norway and Estonia

| | <i>Norway</i> | <i>Estonia</i> |
|---|---------------|----------------|
| Basic building Block-1: Demand Forces (<i>eDF</i>): $eDF = \frac{emf_1 + emf_2}{2}$ | 3.6 | 3.6 |
| Basic building Block-2: Supply Forces (<i>eSF</i>): $eSF = \frac{emf_3 + emf_4 + emf_5}{3}$ | 3.1 | 2.4 |
| Basic building Block-3: Societal Infrastructure (<i>eIF</i>): $eIF = \frac{emf_6 + emf_7 + emf_8}{3}$ | 4.1 | 3.3 |
| e-Readiness (<i>E_r</i>) for each nation: $E_r = \frac{eDF + eSF + eIF}{3}$ | 3.6 | 3.1 |

The e-readiness scores for Norway and Estonia is above the average value of 3.0. (1: the worst score; 5: the best score). Figure 2 depicts the detailed benchmarking of e-readiness based on the eight major factors. In comparison, the average e-readiness values of USA and G7 are 4.3 and 3.9, respectively, on the tool (Bui *et al.*, 2003). The e-readiness of Norway and Estonia is shown in Figure 3 compared with other well-known economies. The reliability of the data used is assured by their sources. Furthermore, a comparison of our e-readiness scores with other e-readiness indices does not suggest marked variances (see Table 3 below). It goes without saying that the comparability of the values adds to the reliability of our computed scores for the two countries. Apparently, there seems to be differences on the two chosen indicators as to the position of the US relative to Norway and Estonia. Perhaps, the indicators used for those indices may explain this variance seen with the relative position of the USA. Thus, our discussion regarding the specific areas as gleaned from our analysis where improvements may be required is succinctly presented below.

Figure 2 Comparing e-readiness by major factors

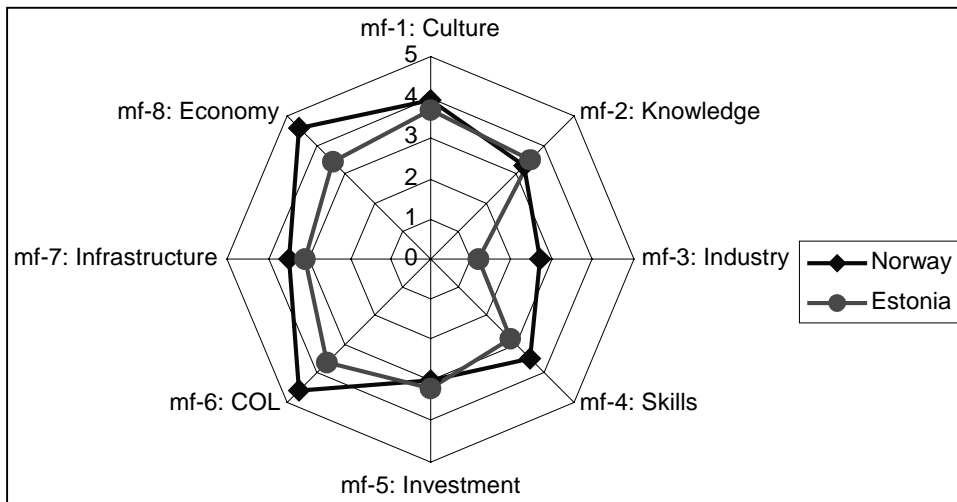


Figure 3 Comparing e-readiness

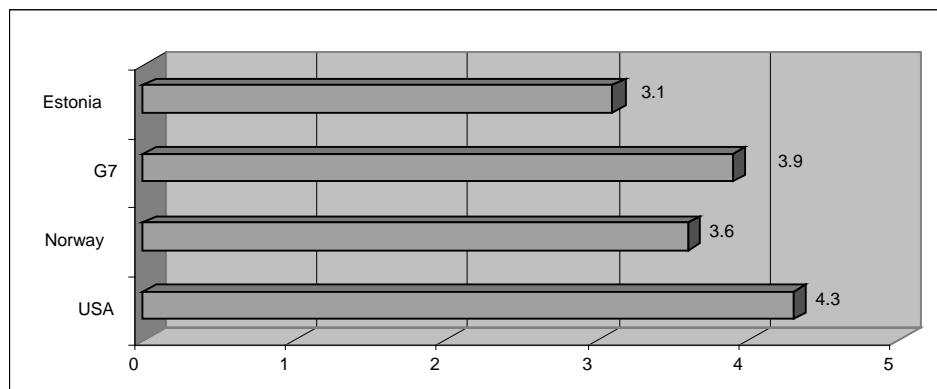


Table 3 Comparison of three e-readiness indices

| <i>Country</i> | <i>World economic forum</i> | <i>Economic intelligence unit</i> | <i>Bui et al.'s, tool (2003)</i> |
|----------------|--|---|--|
| | <i>2003 networked readiness index ranking (out of 6)</i> | <i>2004 e-readiness ranking (out of 10)</i> | <i>E_r: e-readiness (out of 5)</i> |
| Norway | 5.03 | 8.11 | 3.6 |
| Estonia | 4.25 | 6.54 | 3.1 |
| USA | 5.50 | 8.04 | 4.3 |

Specifically, Norway scored highly in factors pertaining to macroeconomic environment and lowly in industry competitiveness factors. Overall, it performs above average in all the major factors. On the other hand, Estonia performs best in factors relating to the overall effectiveness of the society. Nonetheless, the score is still lower than that of Norway's. Further, Estonia records the lowest score in factors concerning industry effectiveness.

A careful look of each indicator shows that Norway scores low in computer processing power as a percentage of worldwide MIPS, flexibility of people to adapt to new challenges, total expenditure for R&D as percentage GNI, foreign direct investment as percentage of GDP, high-tech exports as percentage of manufactured exports, research collaboration between companies and universities, investment in Telecom as a percentage of GDP, and trade as percentage of GDP. In a similar vein, Estonia scored low on items relating to English language usage, total expenditure for R&D as percentage GNI, High-Tech exports as percentage of manufactured exports, extent of staff training, research collaboration between companies and universities, computer processing power as a percent of worldwide MIPS, trade as percentage of GDP, and government effectiveness.

Despite Norway's developed status, there were instances where Estonia (an emerging economy) actually scores higher than its richer counterpart. These can be seen in factors relating to Foreign Direct Investment (FDI) as percentage of GDP, investment in telecom as a percentage of GDP, international Cost of Living (COL) based on US\$100, national culture is open to foreign influence, flexibility of people to adapt to new challenges, administrative burden for start-ups, university education meets the needs of economy, entrepreneurship among managers, adequacy of regulations, and supervision of financial institutions. Likewise there were some indicators in which both countries score exactly the same; for example, on percentage of adult literacy, urban population 65 years and above, and soundness of banks.

Clearly, Norway and Estonia scored extremely low in computer processing power as a percentage of worldwide MIPS mainly due to the size of the population. With populations of four million and one million, respectively, it will be difficult to gain upper hand in worldwide MIPS. However, low scores for the other indicators can be rectified. In particular, the Norwegian government should start working on improving its FDI ratio. It is high time Norway concentrates on attracting FDI to other industrial sectors apart from reliance on its vast (government-controlled) oil export industry. Strengthening other industries will also reduce the influence of trade in GDP; currently, Norway has a large trade-GDP ratio. Norway has a very weak export sector, especially for manufactured

goods. Investment in the telecom sector is low. After many technology investment debacles in the country, private investors are not so enthusiastic about telecom ventures. The government has also problems in investing in the technology sector mainly due to ever increasing healthcare costs. A low score on the indicator for research collaboration between companies and universities fuel this inadequacy. On the other hand, the Estonia government should address the areas in which the country lags behind as it seeks its place within the 'the networked economy'. Overall, a variety of reports have indicated that the country is rapidly industrialising (Kalvet, 2004; World Competitive Yearbook, 2001). However, the country needs to work on its educational sector, which invariably would have a knock-on effect on the levels and quality of its skilled labour. This, in turn, could help improve its industrial competitiveness in the global network economy.

6 Concluding remarks

This paper has attempted to look at the issue of the *digital divide* in Europe by comparing two differing economies in the region: Norway and Estonia, though closely linked by geography, culture and trade, but nonetheless different by their socioeconomic endowments. Notably, Norway is a developed economy, whereas Estonia is an emerging economy. In particular, the e-readiness of the two countries was computed in so far as it is believed that the measure would help quantify the notion of the *digital divide* in the region. To this end, this paper utilised a validated e-readiness tool that has a wide range of building blocks covering all the necessary driving forces (demand, supply and societal infrastructure) in its computation. The data inputs came from reputable sources such as the World Bank, ITU and Heritage Foundation. On the whole, the e-readiness scores obtained are not dissimilar with comparable indices on the issue. Norway and Estonia scored 3.6 and 3.1, respectively, on a scale of 1–5 (1, worst score; 5, best score). Realistically, the closeness of the e-readiness scores somewhat supports the report by Dutta and colleagues (Dutta *et al.*, 2004) as to convergence observed for data or indicators over time pertaining to integrating within the networked economy, for developing/emerging, on the one hand and developed nations, on the other.

We can say that Estonia despite its limited economic resource have done enough in 'catching-up' with one of its richer and developed neighbours in the region, as seen through the lenses of e-readiness. This comparison must be understood as being relative, though. The remarkable progress is best appreciated considering that a decade ago, Estonians in one study ranked poor in telecommunication (telecoms) facilities (Dexter *et al.*, 1993). During those years, such facilities were problematic. Nowadays, Estonia has addressed this deficiency. It has to be understood that telecoms are some of the catalysts in the Information Age. This progress ensures that the country is in tune with its developed neighbours, which helps to narrow any *digital divide*. In contrast, countries in other developing parts of the globe are still struggling with their infrastructural base (WSIS, 2004; InfoDev, 2004; Joi, 2004; Ifinedo, 2004).

Overall, this paper highlighted for each country, areas of strengths and weakness as uncovered in the computations and some suggestions proffered. Essentially, the recent EU membership of Estonia (World-News Watch, 2004a) undoubtedly would further ensure more rapid convergence that could diminish any *digital divide* between Western Europe (*e.g.*, Norway) and Eastern Europe (*e.g.*, Estonia). This paper has shown through the comparison of e-readiness scores that some differences still exist in regard of the

notion of *digital divide* in the Nordic region of Europe; albeit, with respect to the two selected countries in the paper, this does not appear to be huge.

Nonetheless, a note of caution must be sounded off. Most e-readiness tools are often descriptive and diagnostic in nature, and they tend to rely on historical data. Up-to-date data may reveal contrasting evidential facts to the one discussed herein. The findings in this article, in particular where areas of strengths and weaknesses are identified could be useful to policy makers in the region in determining areas where future efforts could be channelled. At the country level, both countries may take one look at the results of this paper vis-à-vis other available input as national plans (with respect the global networked) are drawn. Increasingly, e-readiness scores/measures are being used by national governments for such purposes (India: E-readiness Report, 2003). To sum up, Estonia's e-readiness is comparable to that of Norway's. Thus, the existence of the *digital divide* for the two economically differing Nordic countries may in fact be minimal or perhaps short-lived, as more regional assistance and cooperation are fostered.

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