Pirjo Ståhle & Sten Ståhle

EDUCATION INTELLIGENCE SYSTEM (EIS)

FFRC eBOOK 7/2007

FFRC eBook 7/2007

EDUCATION INTELLIGENCE SYSTEM (EIS)

Pirjo Ståhle & Sten Ståhle

ISBN 978-951-564-512-8
ISSN 1797-132

Finland Futures Research Centre
Turku School of Economics
Rehtorinpellonkatu 3, FI-20500 Turku
Korkeavuorenkatu 25 A 2, FI-00130 Helsinki
Hämeenkatu 7 D, FI-33100 Tampere
Tel. +358 2 481 4530
Fax +358 2 481 4630
www.tse.fi/tutu
tutu-info@tse.fi, firstname.lastname@tse.fi

CONTENTS

INTRODUCTION

This study was undertaken as part of the Future Probe project by the Confederation of Finnish Industries EK, where one of the aims is to develop a system for monitoring and forecasting training, education, skills and qualification needs in Finland. At this stage the object is to create a system that relies mainly on statistical indicators to assess the current situation and to project future trends in Finland. This report offers an introduction to such a tool and describes a simplified practical application with examples. The Education Intelligence System (EIS) has been developed by the authors of this report, Professor Pirjo Ståhle and analyst Sten Ståhle.

The EIS foresight concept makes use not only of statistical indicators, but also verbal descriptions of trends; numeric time series descriptions of trends; and expert views and opinions (through the forums of expert and Delphi groups).

The EIS model draws heavily on two perspectives, i.e. a *trend analysis and theoretical perspective*. It identifies *global trends* that provide a maximally reliable forecast of long-term effects (10 –20 years plus) and combines them with *short-term market and social trends*.[1] The model also integrates social and behavioural variables (e.g. changes towards more individualistic consumption patterns) insofar as the underlying trends are known to be reliable and long-term.

The theoretical foundation for the model was developed by analysing and integrating the dual frameworks of national competitiveness and intellectual capital.[2] For competitiveness, the model uses key indicators from major international sources (WEF, IMD, EU). For intellectual capital, the model draws on the National Intellectual Capital Index (NICI)[3] and Dynamic Intellectual Capital[4] based on the knowledge environment theory.

The report is organized into three sections. The first section deals with the *general criteria for the EIS model and the principles of using statistical data* as foresight sources. In addition, we discuss the conditions and requirements for a foresight model that is based on trends and indicators and consider the choice of data sources.

The second part discusses the *theoretical premises* of the EIS model, which were developed primarily out of the frameworks of national competitiveness and intellectual capital. The framework applied in the

[1] One example of a global trend is the imperative to discover and harness new forms of energy. An example of a short-term market trend is the growing use and application of ICT products.

[2] The model does not address the theoretical background of the indicators describing social changes.

[3] Bontis 2005.

[4] Ståhle et al. 2002.

EIS model determines the main elements of national competitiveness, which in turn determine the choice of indicators for the foresight exercise.

The third section of the report describes a *practical application of the EIS concept*, demonstrating how international comparative indicators can be used in a relatively simple tool for purposes of forecasting education, skills and qualification needs. Examples are included to demonstrate the use of this tool. In addition, the third section describes the whole EIS concept, including the consultation of national opinion leaders and expert groups.

The first and second parts of the report constitute the methodological foundation for forecasting skills and qualification needs. In order that the large mass of indicators can be reduced into a clear enough picture for informed decision-making on educational policy, for instance, the practical application of the EIS concept requires a) data compilation by means of background surveys or reviews or b) the development of software for data processing. Nevertheless even without these additional resources it is possible to apply at least the basic principles of EIS. Indeed, this report also demonstrates a practical (albeit somewhat simplified) way of using indicator data for forecasting education, skills and qualification needs.

1. USING TRENDS AND STATISTICS TO FORECAST EDUCATION AND QUALIFICATION NEEDS

This Chapter discusses the general criteria for the EIS model and the principles of using statistical sources as tools of foresight. Furthermore, it considers the general conditions for the use of trends and indicators in foresight exercises as well as the identification of threats and opportunities.

1.1 General criteria for EIS model

The EIS model is grounded in trend analysis. Trends vary in terms of both their reliability and time span. Fashion, for instance, is a trend that has a time span of six months. A market force is a short-term trend with a time span of 1–3 years. Ecological and technological changes describe long-term trends with a time span of 10 years plus.

A workable foresight model must include components that integrate these trends in a meaningful way with the definition of education, skills and qualification needs. Short-term trends can be used to forecast skills and qualification needs only in those areas of the education system where changes can be implemented very quickly. Long-term trends can be used in core areas of the education system, such as in developing the curricula of upper comprehensive and senior secondary schools and in structures that support lifelong learning.

Generally, then, the EIS model needs to meet the following criteria:

- The requirement of *economic productivity* is a major restrictive determinant of education, skills and qualification needs in the EIS model: the model is expected to forecast needs that directly or indirectly and with a very high probability promote economic productivity and national competitiveness.
- The model must be *independent of current economic clusters*. This is an important criterion because
    - clusters do not cover the whole national economy
    - the model must also be able to identify alternatives, such as new key technologies; this places the added requirement that the model must be applicable at the industry level.
- The component of the model that is linked with economic clusters must include a mechanism that allows for the early identification of internal *changes and threats* within the economic cluster.
- The model must include a mechanism that allows for the early identification of *positive signals*, the economic opportunities created by new market potential or new technology.

- The model must accurately identify skills and qualification needs in terms of both content and level. Content indicates the type of education, skills and qualifications that are in demand, whereas level refers to the structures of the education system. In the concept of Building Engineer, for instance, building industry skills refer to content and engineer to the level of the qualifications.

NB

Education, skills and qualification needs can be predicted more easily and with greater accuracy if the foresight exercise is not constrained by requirements of economic productivity or efficiency. It is easier to envision the ideal state of affairs than to predict whether that state of affairs would also be economically beneficial. For example, there are well-established trends suggesting an imperative to invest in environmental know-how and technology, but it is impossible to predict with any certainty whether those investments would be profitable. Innovation is an important aspect of national intellectual capital and national competitiveness. For this reason innovation skills are an important education need *a priori*. However, innovation must be understood broadly and applied not only to technology or economic clusters, but also to the development of economic structures.

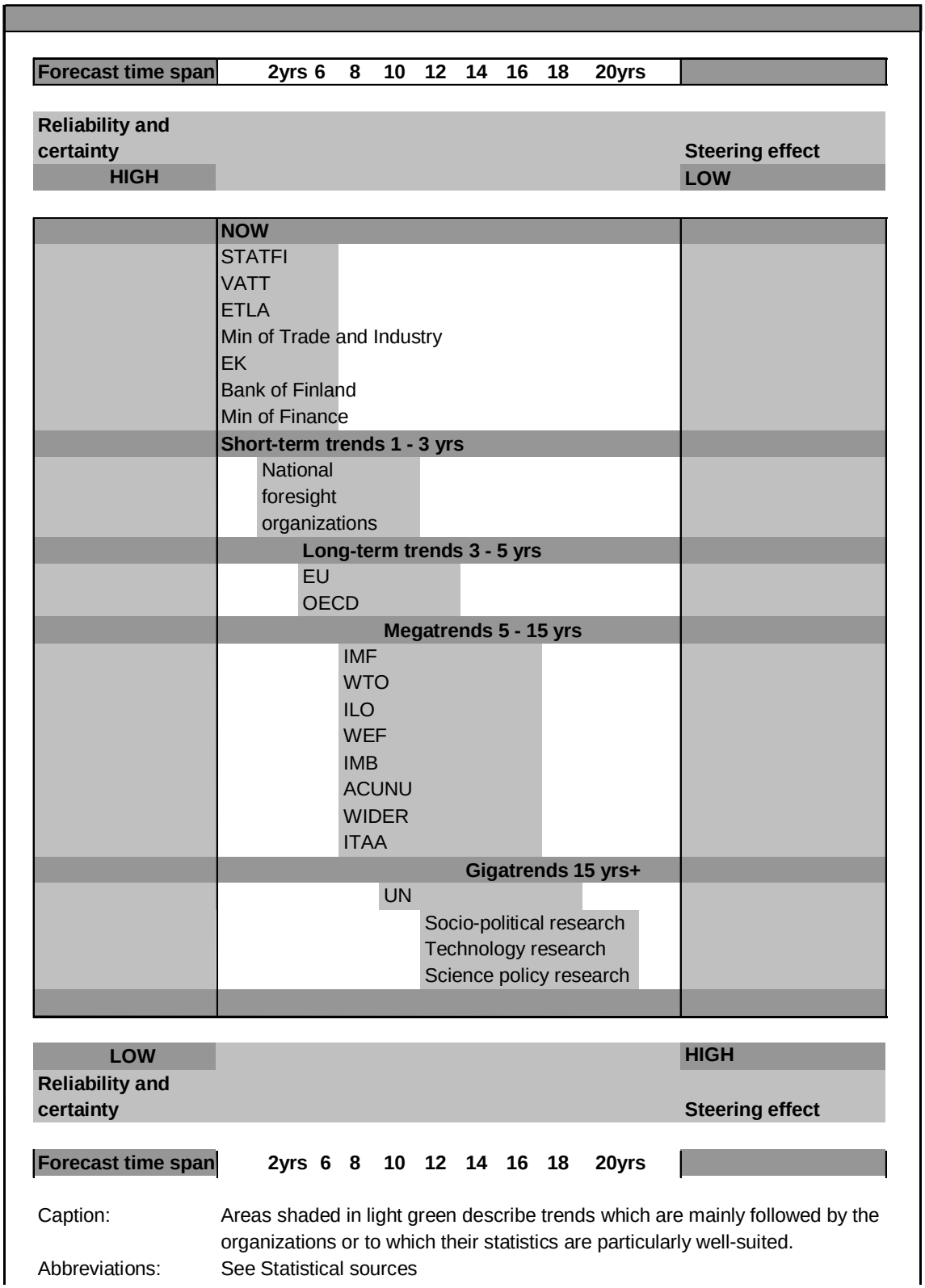
The relationship between innovation and productivity is complex and multifaceted:

- Research and innovation that is not constrained by requirements of productivity is more likely to yield results than research and innovation governed by strict requirements of economic efficiency.
- Innovation that is based on global networking is the most efficient of all. Research and innovation that is tied to economic clusters can therefore ensure the competitiveness of the cluster, but it will not necessarily identify new market potential.
- Innovative and experimental business is bound to leave bankruptcies, economic entropy and sunken costs in its wake. In this situation the competitive edge will be gained by the society that reaps the greatest learning benefits from the bankruptcies. The requirements imposed by innovation on economic structures at the societal level have received only scant attention so far.

1.2 Statistical sources for the EIS model

In our background research we have reviewed all the major national and international organizations that compile indicators or statistics that are suitable for purposes of foresight and trend analysis. These sources were preliminarily assessed for the reliability of their forecasts, the time span covered, and steering effect. The most important sources are listed in Table 1.

Table 1. Statistical sources and their positions by reliability and steering effect.



Caption: Areas shaded in light green describe trends which are mainly followed by the organizations or to which their statistics are particularly well-suited.

Abbreviations: See Statistical sources

Key observations on statistical sources:

- Statistical sources can be divided into three groups that describe
    - economic efficiency or competitiveness
    - social trends
    - national intellectual capital

- In all categories the indicators typically focus on the present time. Economic trends rarely extend beyond growth projections for one or two years. The time span of global and social trends extend the furthest into the future (e.g. ageing Europe), while environmental trends can extend as far ahead as 2050 –2100. The time span covered by the trend is influenced by the underlying
    - regularity or lawfulness
    - volume
    - both factors (e.g. ecosystem forecasts).

- When the time spans and reliability of trends and forecasts are compared with the time span and reliability requirements in the development of the education system, it is clear that indicators in themselves are virtually useless.

- Indicators that measure economic efficiency and growth and those that describe trends are not grounded in any unified theoretical model. There are, however, some underlying features that they share in common. All models describing advanced countries emphasize the following preconditions for success:
    - a workable infrastructure
    - national and international networking
    - investment in product development
    - social stability and equality

- Scenarios proposed by different organizations are very general and/or include too many credible alternatives for them to be useful for purposes of indicator-based monitoring.

There is no existing model, theory or battery of indicators that could be used as such for forecasting education, skills and qualification needs. The time span of this foresight exercise has to extend more than 10 years ahead so that it can steer the slow-to-react national education system.

Short-term education policy decisions can be based on the current situation and current indicators (e.g. rapid measures to increase ICT skills and competencies, shortage of medical doctors, health care services).

1.3 Characteristics of the statistical data used

The EIS foresight model can use statistics and indicators that have been shown to, or that can reasonably be assumed to *directly or indirectly* influence the development of economic welfare, national well-being or national intellectual capital, or that are known to clearly *reflect or measure* these dimensions.

An example of this kind of statistical and social indicator is the association between the performance and transparency of democracy with economic welfare. A true and transparent democracy produces economic welfare, which in turn is conducive to true democracy.[5] At some point, though, democracy reaches saturation point, beyond which the benefits to the national economy will have been exhausted, i.e. beyond which national welfare and well-being can no longer be increased by increasing democracy.

This democracy example also highlights an important aspect of our foresight model: this model is necessarily non-linear and involves some internal overlap. Non-linear, in this connection, means that statistical variables can have mutually contradictory effects. A factor that at one level promotes positive economic development may at another level hamper economic development. For example, urbanization, in itself, has the effect of strengthening the infrastructure and boosting economic development. At the same time, though, urbanization threatens to endanger the environment and to undermine people's quality of life, which in turn is a threat to sustainable economic growth.

1.4 Global trends

A global trend refers to a sliding conception of change or factors driving change that because of their extent or permanence have a global impact on the environment and its structures. The impacts of global trends are not only extensive and long-term, but also slow. An example is provided by environmental changes.

However an interesting aspect of global trends is that their dynamics is very similar to that seen in the development of emerging technologies. The trend steers the course of development and generates business that requires skills and expertise – sometimes the development of a whole new technology (cf. environmental technology or the pharmaceuticals industry).

[5] Inglehart 1997

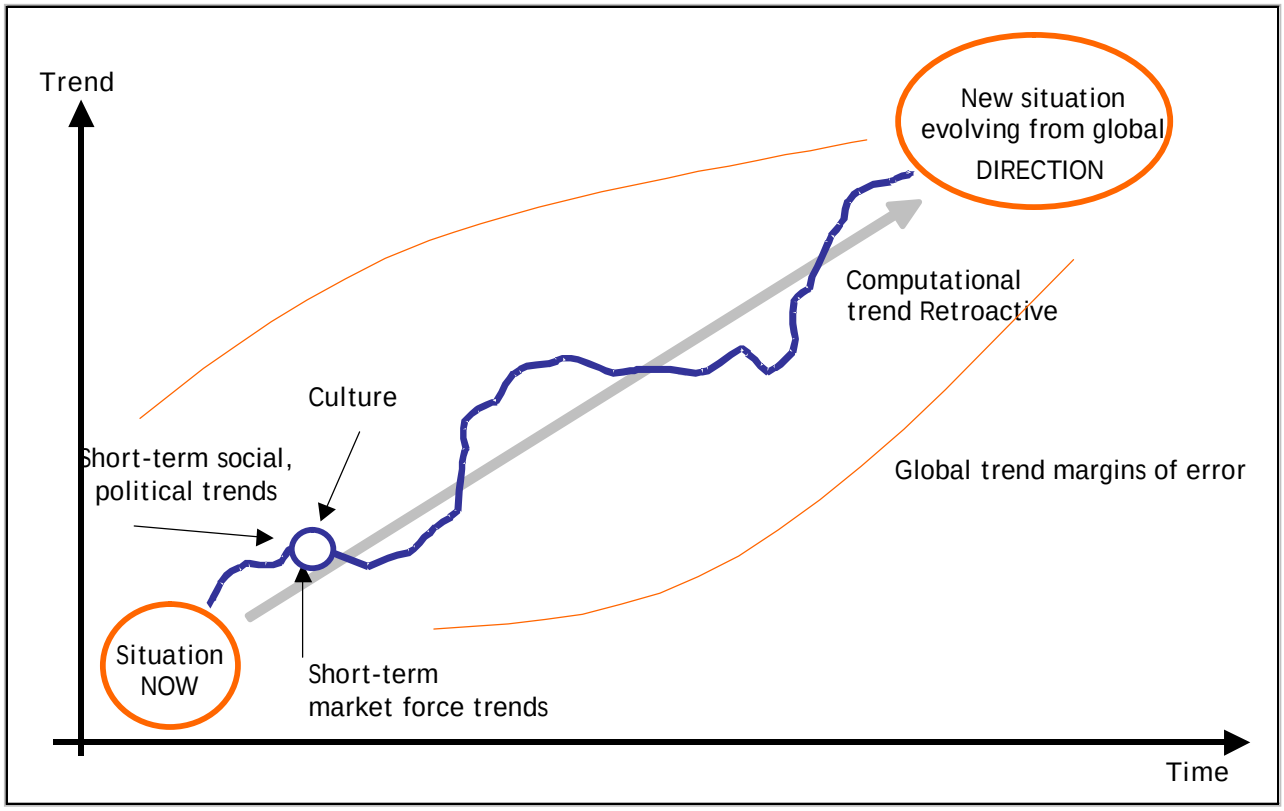


Figure 1. Steering effect of global trend.

Monitoring emerging technologies is closely related to forecasting the development of economic clusters and industries and to identifying new potential markets and areas of competence. New technologies create both *opportunities* and *threats.* An example of a developing threat is the growth of artificial intelligence combined with robotics, which in theory could make redundant all manual labour. This would have significant implications in areas of production that rely on the use of cheap labour, for instance. At the same time, the large-scale application of artificial intelligence would create a whole new market, e.g. for robots equipped with artificial intelligence.

In this context it is particularly interesting to consider the new areas of business that evolve around key technologies, the skills and competencies they require and the question of proper timing. Every new emerging technology invariably and inevitably generates new business, but it is very difficult to predict the time span. The potential of the computer, for instance, was first recognized in the early 1900s, yet it was not until the 1940s that the computer was actually "invented "and from the 1980s onwards that it developed into big business. In other words, the time span here covers a period of almost 100 years. On the other hand, the phenomenal breakthrough of the Internet and its impact on everyday life in all sectors of society took everyone by surprise with its sheer speed and magnitude.

1.5 Statistical monitoring of trends

Trend estimates and projections of future megatrends are produced among others by the following international organizations:

UN	United Nations
EU	European Union
IMF	International Monetary Fund
WB	World Bank
WTO	World Trade Organization
ILO	International Labour Organisation
OECD	Organisation for Economic Co-operation and Development
WEF	World Economic Forum
IMD	Institute for Management and Development
WIDER	World Institute for Development Economics Research
CSIS	Centre for Strategic and International Studies

It is noteworthy that many of these organizations have important sub-organizations that produce statistics and trends in different fields. In the case of the UN, examples include the WHO, UNESCO and ACUNU (American Council for the United Nations University).

The statistics and trend projections presented or used in this report meet our criteria with respect to *content, reliability and coverage*. All the international organizations listed above produce reliable and comprehensive core statistics as well as clear short-term trend projections. Most composite indexes (CIs) that measure background factors or macro-level variables are also compiled on the basis of a sufficiently large number of statistical variables (e.g. IMD 314, WEF 188 statistical variables). However, it is important to note that CIs always involve an element of interpretation or theoretical application that is open to questioning.

The international organizations mentioned above do not produce actual forecasts of the future development of the content or structure of education; nor can their indicators be assessed in terms of their steering effect on education. What these indicators do allow countries to do is position themselves in relation to other countries and the current competitive situation. In other words, statistics, trends and indicators have no direct steering effect on decision-making, but they do inform decision-making.

The steering effect depends on how different countries in different situations can take advantage of the opportunities open to them.

Forecasts of education, skills and qualification needs must be so compiled that they

- maintain and strengthen the current favourable trends in national competitiveness, intellectual capital and social development; and
- take account of the realities of global development.

1.6 Prevailing megatrends

The megatrends presented here are based mainly on statistical sources and analyses by the following organizations: WEF, IMD, UN, EU, IMF, WB, WTO, ILO, OECD, WIDER and CSIS. The megatrends must be extracted from the summaries and conclusions offered by these organizations in their publications that come out once a year or every other year. Based on current analyses we can identify more or less consistently at least the following megatrends from these sources:

1. In advanced economies, competitiveness will continue for some time to come to depend on product development and innovation.
2. Major threats include the saturation of current and old markets and the gradual depletion of cheap labour in the wake of increasing wage equality.[6]
3. The development of new markets will require sustained growth of a middle class with substantial purchasing power. In the long term this will require strong growth of social welfare in Africa and South America as well as stable social and political development in transition and emerging economies.
4. Logistics will continue to gain increased importance. This applies both to the structures of global capital and to production factors. One important aspect here is the (re)location of production units as close as possible to both raw material sources and to new, growing markets.
5. As global cost structures continue to even out, a new emerging threat will be presented by the drain from advanced economies of core occupations, operative labour and production plants. In the long term it is expected that once the wage and investment benefits have been exhausted, core occupations and production will begin to flow back into advanced economies. Preparedness should be retained.
6. The maintenance of current standards of welfare and the containment of related costs in advanced western countries will require immigrant labour and rigorous cost controls.
7. The service sector will expand, as will leisure services and related occupations.
8. Consumption patterns will continue to become more individualized.

[6] Competitiveness based on low cost does not, however, last very long. History shows that successful nations have a tendency to close the labour cost gap relatively quickly. For example, in 1980, the total labour cost in manufacturing was $5.52 in Ireland and $6.03 in Japan. In 2004, the figures were $21.02 and $21.54, respectively. The same trend is likely to occur in Central Europe, especially in the Baltic states where current growth rates are very high. IMD Yearbook 2005, p 43.

9. Energy, raw materials and clean environment will continue to gain in economic, political and human significance and to have ever greater impact on economic and social structures.
10. Ecological changes will generate both new technologies and new markets.
11. Emerging technologies will reach critical point and create new markets, and possibly change the structures of commerce and the economy.

1.7 Megatrend categories

Megatrends indicate the general direction of things to come, providing a platform for monitoring

- internal developments within the megatrend itself (constancy, extent and duration of the trend)
- national position-taking vis-à-vis the trend (are national investments, national economic development and decision-making concerning the future compatible with the challenges and requirements presented by the megatrend).

It is necessary, therefore, to follow megatrend indicators and statistics at both the *international* and *national* level. The following 11 categories are based on the global trends identified by the WEF, IMD, EU, UN, IMF and World Bank as having a potentially major impact on the future development:

1 Product development and innovation
2 Markets and cost structures
3 Africa, South America and emerging and transition economies
4 Logistics and infrastructure
5 Primary production
6 Social welfare and stability
7 Service sector
8 Changes in values and consumption
9 Energy and raw materials
10 Ecological variables
11 Emerging technologies

These trends can be monitored in the summaries and annual reports compiled by the organizations concerned. The trends are usually described in verbal form. Changes in skills and qualification needs in Finland can be analysed by studying the impact of global trends on the country's political development as well as its values, economy, technological development and industries. In order that changes in skills and qualification needs can be translated into concrete decision-making in education policy and other areas, it is important to identify the impacts of global trends on the cluster and industry level.

1.8 Early warning system

The identification of weak signals of new threats and potential new opportunities are an important part of trend analysis. The purpose of the early warning system (EWS) is to monitor trends within a *cluster or industry* and to identify as early as possible any emerging new threats to the development of the cluster or industry.

Below is a list of recognized EWS variables that might have significant impact:

- Internal development within market growth areas, incomes development, changes in purchasing power.
- Political and economic stability of transition economies (e.g. China, India and Russia).
- Development of potential Third World market areas, including the possible expansion of the so-called Triple Threat within Africa or from Africa to South America or other areas.[7]
- Higher than anticipated level of development investment among competitors or higher than anticipated number of national patents issued.
- Impacts of an emerging technology on industry operating environment, efficiency or need for structural change. An example is provided by the integration of automation with artificial intelligence or logistics and their impacts.
- The saturation of current markets or market areas. This is a quite clear EWS variable. The threat of saturation forces out either new market areas, new applications or new products or product versions on old markets.

Although the principles of EWS analysis are fundamentally clear and straightforward, there exists no single, universal EWS strategy. EWS is a tool of targeted analysis that must be focused as closely as possible on each variable, within its context and environment. Generally speaking, however, EWS can be broken down into the following constituent elements:

- cluster or industry variables
- emerging technology variables
- general social variables

These data can be found in national and international statistics that are produced by Finnish Customs and the WTO, for instance.

[7] Triple Threat: AIDS (1) destroys social structures (2) and causes desperate poverty (3), because the social structures have collapsed. Source: UN (2003; www.reliefweb.int/rw/rwb.nsf/db900SID/ACOS-64BKR6?OpenDocument). In theory it is possible that this phenomenon could spread to Russia and the Baltic states, for example.

1.9 Sensitivity to weak signals of change

Sensitivity to weak signals (SWS) is a monitoring system and analytical tool coupled with an *emerging technology, key technology or global trend*. In the case of an emerging technology, the object of SWS analysis is to establish as early as possible the point at which the technology becomes commercially viable, or at which point its introduction will have a significant impact on economic structures. In the case of global trends, the purpose of SWS analysis is to establish at which point the changes or pressures of change created by the trend have increased to such an extent that they will lead inevitably to social or economic changes or generate new business or new technology. An example of the development of an emerging technology is provided by the history of today's home PC and entertainment electronics. As for the impact of global trends, an example here is provided by the growth of environmental technology and its evolution into a business (including recycling).

Each process of change has a critical point and critical mass where the impacts change fundamentally, both in terms of quality and quantity. In economic terms this is the point where the business transforms from marginal into significant.

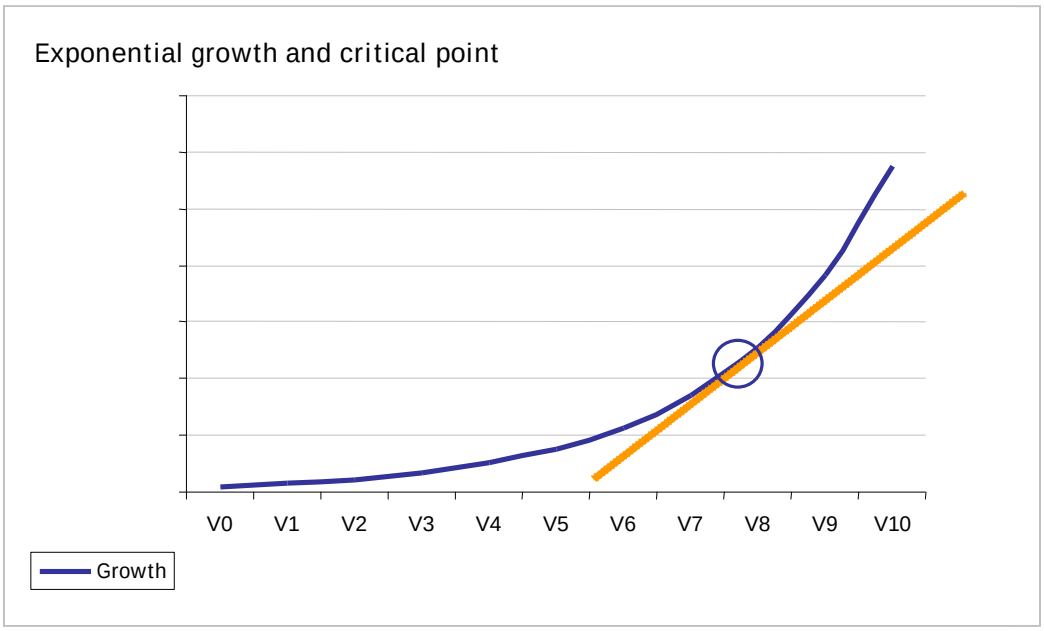


Figure 2. Critical point in trend.

The aim in SWS analysis is to identify and predict the critical point in an emerging technology or global trend as reliably as possible. In Figure 2, the critical point is identified when the growth rate is sharp enough (red line).

Following are some examples of international SWS variables whose joint effects should allow us to forecast significant changes:

1. Emerging technologies product development input
2. Emerging technologies investment
3. Emerging technologies business profitability
4. Emerging technologies business value as a proportion of stock exchange value
5. Emerging technologies turnover as a proportion of GDP
6. Emerging technologies business companies as a proportion of national business stock

A significantly high *level, share or growth* for these variables serves quite reliably to predict the critical point. The reason for this is that the same factors are at once distinctive characteristics of profitable business.

EWS is a pragmatic tool and allows for systematic monitoring of market development, market saturation and the emergence of new markets. SWS is less straightforward. Here the focus is on intra-industry changes (e.g. number of new businesses set up in the nanotechnology field), and the monitoring also involves a strong element of human evaluation.

2. COMPETITIVENESS AND INTELLECTUAL CAPITAL AS A BASIS FOR FORESIGHT

In this second part of our report we outline the theoretical foundation of the EIS foresight model. This theoretical discussion is necessary because in the absence of an underlying theoretical framework, individual indicators could be used quite haphazardly. Likewise, without a theoretical understanding, the choice of indicators would remain a detached and random exercise, determined by each individual analyst's personal views or end-purposes. However the theoretical discussion here does not go any deeper than is necessary to justify the EIS model.

The EIS foresight model is based on the frameworks of national competitiveness and intellectual capital. For the part of competitiveness, we rely on the most important and relevant indicators drawn from international sources (WEF, IMD, EU). For the representation of intellectual capital, we use the National Intellectual Capital Index (NICI)[8] and the knowledge environment theory of Dynamic Intellectual Capital.[9]

We begin our discussion with an overview of the concept of national competitiveness and related indicators. Next, we proceed to examine national intellectual capital, its relationship to national competitiveness and its applicability to our foresight model. This analysis will yield an integrated framework of the elements of national competitiveness, which include the dimensions of intellectual capital. This model will serve as the basis for the choice of indicators used in the foresight exercise.

Figure 3 below illustrates how these factors are associated with *global trends and emerging technologies*, which were discussed in the first part of the report.

[8] Bontis 2005.

[9] Ståhle et al 2003, Ståhle & Grönroos 2000.

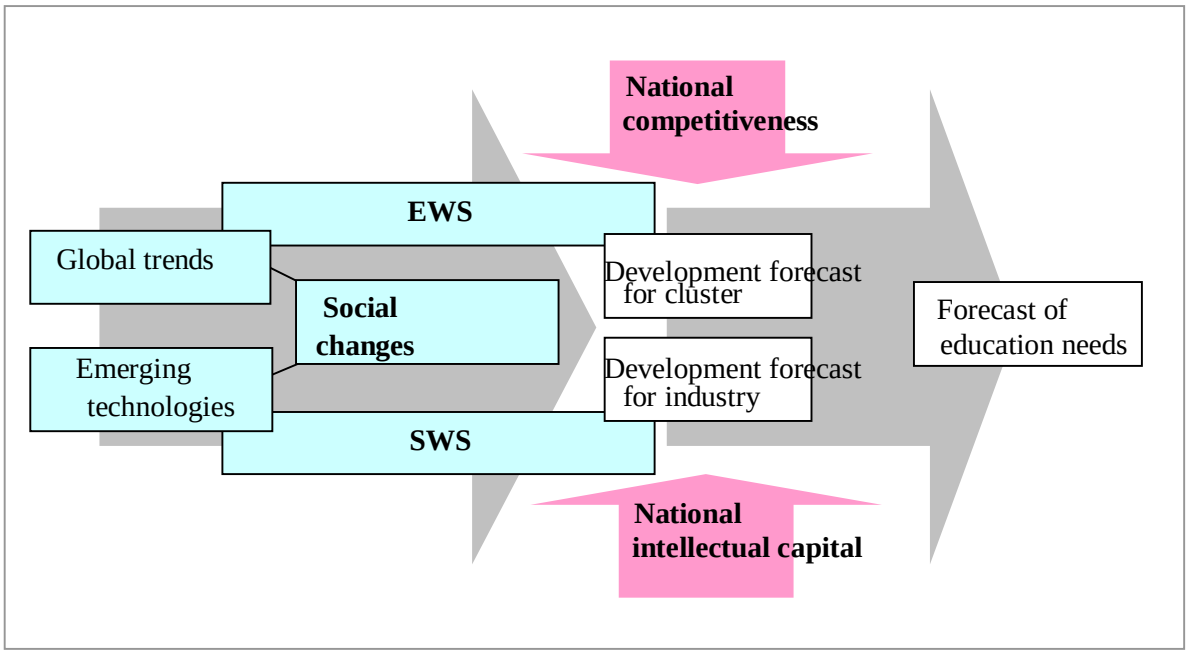


Figure 3. Component factors in forecasting education, skills and qualification needs.

In our EIS foresight model, global trends, national competitiveness and intellectual capital are factors that can be described by means of statistical variables. Together, they constitute the statistical mass that along with EWS and SWS analysis allows us to forecast cluster or industry developments. The analyses determine

- which statistical variables influence the cluster / industry
- how the impact of the statistical variable is interpreted, i.e. whether it is considered to strengthen or undermine the growth of the cluster.

Localized changes at the cluster and industry level are an important part of forecasting skills and qualification needs because the economic steering influence of those needs is channelled via those changes. However it has to be noted that the future development of education, skills and qualification needs is to a great extent determined by the impact of global trends. An example is provided by skills and qualification needs created by networking or teleworking, which are reflected in all industries.

2.1 National competitiveness

Comparisons of national competitiveness are not informed by any single coherent theory that explains the conditions for a nation ś success or the growth or competitiveness of an individual economic cluster. Indicators of competitiveness (such as those produced by the WEF and IMD) have different underlying premises and use different statistical sources, and therefore they yield somewhat different results. However all indicators of national competitiveness do share certain features in common, a similar basic

structure and a similar way of handling statistical material. Furthermore, all agree that competitiveness is structured around three core dimensions:

- a comprehensive and functioning infrastructure
- operative networking, regional and global integration and interaction with the environment and stakeholders
- operational development, structure and efficiency of innovation

There is a certain amount of overlap between the concepts of national competitiveness and national intellectual capital. The future of a state, nation or people depends largely on national competitiveness, which in turn depends on national intellectual capital and the ability to put that capital to good use. Both have an impact on skills and qualification needs, which are determined on the basis of the following chain:

- Global developments determine which factors produce competitive advantage at any given time.
- Competitive advantage, for its part, consists of tangible and intangible resources and the way they are integrated. In advanced countries this increasingly means national intellectual capital.
- Skills and competencies must be developed in such a way that they add to the intellectual capital that produces national competitiveness.

A whole array of different definitions have been offered for national competitiveness:

WEF (Porter):

A nation's prosperity depends on its competitiveness, which is based on the productivity with which it produces goods and services

→ economic and business perspective

IMD:

Competitiveness analyses how nations and enterprises manage the totality of their competencies to achieve prosperity or profit.

→ education and intellectual capital perspective

European Commission:

... a sustained rise in the standards of living of a nation and as low a level of involuntary unemployment as possible.

→ economic and social perspective

US Presidential Commission:

the degree to which a nation can, under free and fair market conditions, produce goods and services that meet the test of international markets while simultaneously expanding the real incomes of its citizens

→ economic and development perspective

These different definitions are not inherently contradictory, instead they highlight the fact that national competitiveness involves complex dependencies on economic, social and cultural factors. Table 2 provides a rather simplified and crude demonstration of the different ways in which statistical variables have been grouped and classified in different surveys of competitiveness. All the indicators used can be placed into three main categories:

- economic and financial indicators
- political, social and environmental indicators
- intellectual capital indicators

The classification in Table 2 is based on the original indicator clusters, which is why an individual indicator may appear under the wrong main heading (e.g. column WEF/main category IC/indicator Health and Environment). As we can see, different organizations emphasize different categories as sources of competitiveness and have different interpretations of individual indicators (for instance, IMD classifies technology as a macroeconomic growth factor, whereas the EU places technology under the heading of Innovation and Research).

Table 2. Comparison of major classifications of competitiveness indicators.

Institute	World Economic Forum	Institute for Management Development	European Union EU Structural Index	United Nations UN Millennium Development Goals
Key Indicators	WEF	IMD	EU SI	UN MDG
Economic and financial	Economic Performance Domestic Economy International Trade International Investment Employment Prices Business Efficiency Productivity Labour Market Finance Management Practices Attitudes and Values	Growth Competitiveness - Technology - ICT - Innovation - Technology Transfer - Macroeconomic - Environment - Macroeconomic Stability - Country Credit Rating Microeconomic Competitiveness - Company Operations and Strategy - Quality of National Business - Environment - Business Readiness Usage Component Business Usage	General economic background - GDP per capita - Labour productivity - Unemployment rate - Inflation rate - Real unit labour cost growth Economic Reform - Relative price levels and price convergence - Prices in network industries - Market structure in network industries - Public procurement - Sectoral and ad hoc State aid - Capital raised on stock markets	Eradicate extreme poverty and hunger Develop a global partnership for development
Political, social and environmental	Government Efficiency Public Finance Fiscal Policy Institutional Framework Business Legislation Societal Framework	Public Institutions Index Corruption Contracts and Law Environment Component Index - Market Environment - Political / Regulatory - Infrastructure - Government Readiness - Government Usage	Public Employment - Employment rate - Employment rate of older workers - Gender pay gap - Tax rate on low-wage earners balance - Accidents at work Social Cohesion - Distribution of income (income quintile ratio) - Poverty rate before and after social transfers - Persistence of poverty - Regional cohesion - Early school-leavers not in further education or training - Long term unemployment Environment - Greenhouse gas emissions - Energy intensity of the economy - Volume of transport relative to GDP - Modal split of transport - Urban air quality - Municipal waste	Promote gender equality and empower women Reduce child mortality Improve maternal health Combat HIV/AIDS, malaria, and other diseases Ensure environmental sustainability
Education, IC and general knowledge base	Infrastructure Basic Infrastructure Technological Infrastructure Scientific Infrastructure Health and Environment Education	Global Information Technology Networked Readiness - Individual Readiness Usage Component - Individual Usage	Life-long learning Innovation and research - Public expenditure on education - R&D expenditure - Level of Internet access - Science and technology doctorates - Patents Venture capital	Achieve universal primary education

The nation's competitiveness thus covers different performance indicators from the following areas of society:

- economy and business
- social, political and environmental factors
- cultural, educational and innovation factors

2.2 National intellectual capital

Intellectual capital (IC) has also received many different definitions. All these definitions, however, share the same understanding that intellectual capital is essentially about *generating economic value out of skills and knowledge*.

The original structure of intellectual capital was first developed and described by Leif Edvinsson. Since his pioneering work, several different variants and applications have been put forward within the research tradition of intellectual capital.

National wealth and prosperity consists of two main components, i.e. financial and intellectual capital. Intellectual capital consists of the skills and competencies of individuals as well as of social structures. Social structures can in turn be divided into market and organizational capital – and organizational capital can be further divided into process capital and renewal capital (Figure 4). Based on this classification, Nick Bontis has created the National Intellectual Capital Index (NICI), which involves the following components:[10]

* Human capital

  Knowledge, education and competencies of individuals.

* Process capital

  Non-human storehouses of knowledge embedded in technological, information and communication systems as represented by its hardware, software, databases, laboratories and organizational structures.

* Market capital

  Intellectual capital embedded in national intra-relationships. Represents a country's capabilities and successes in providing attractive, competitive solutions to the needs of its international clients. Social intelligence created by laws, market institutions and social networks.

* Renewal capital

  Nation's future intellectual wealth, capabilities and actual investments, results of investments in R&D, patents and scientific publications.

[10] Bontis 2005, 115.

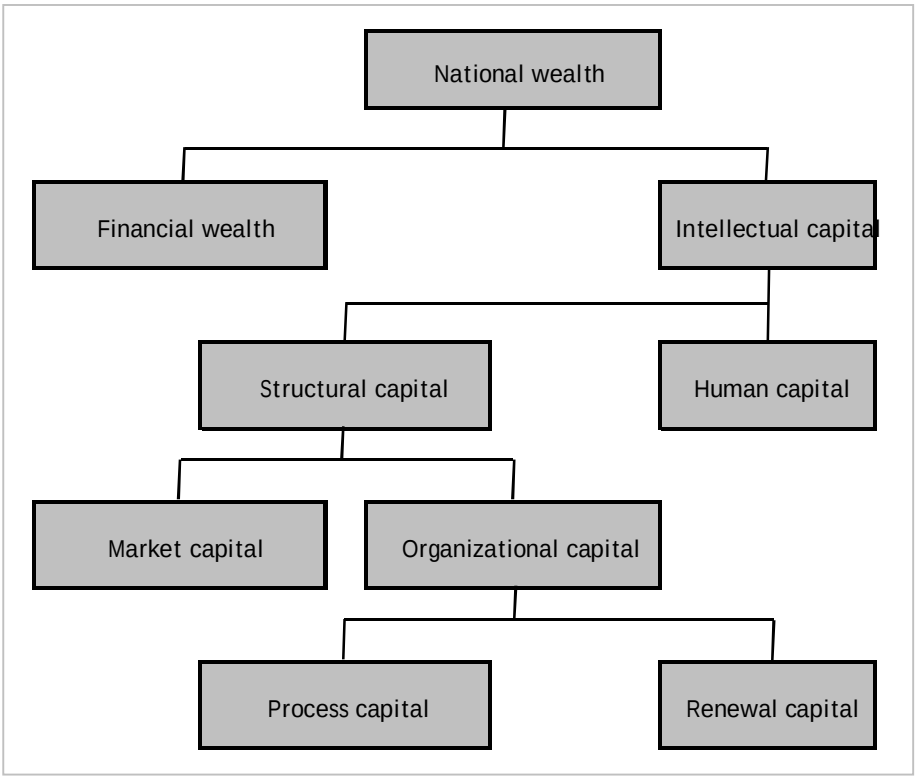


Figure 4. Components of national intellectual capital (Bontis 2005, based on Edvisson and Malone 1997)

A comparison of these IC categories with the indicators used by the WEF, EU and IMD immediately shows that they all comprise largely the same factors. This is hardly surprising in view of the notion inherent in intellectual capital that knowledge creates competitive advantage and, secondly, that knowledge itself is rarely directly measurable. Instead, knowledge is embedded in and only manifested through practices, technologies and social structures.

National intellectual capital has been defined among others as referring to:

> *"...hidden values of individuals, enterprises, institutions, communities and regions that are the current and potential sources of value creation "*(Bontis 2004,4)

> *"... all intangible resources available to a country or a region, that give relative advantage, and which in combination are able to produce future benefits* "(Andriessen & Stam 2005).

One of the features shared in common by all definitions of intellectual capital is that they underline the (economic) value-generating effect of knowledge. It is immediately clear that definitions of intellectual capital are very similar to those of national competitiveness.

The frameworks of intellectual capital and competitiveness share some general weaknesses that need to be taken into account in the EIS foresight model. First of all, they are both very static in the way they

describe various factors as indicators and in the way they group these indicators into different classes or categories. Neither is able to capture dynamic or systemic factors that in the last instance determine how effectively a nation can perform in what is a constantly changing, global environment. For this reason the EIS foresight model also incorporates the framework of *dynamic intellectual capital*.

In the *Dynamic Intellectual Capital (DIC)* model,[11] continuing competitive advantage is regarded as the joint outcome of three operating and knowledge environments. The DIC theory has it that for organizations[12] to maintain their *capacity for constant renewal, there must be a high level of mutual interaction between the mechanical, organic and dynamic operating environment.* Renewal requires action and structures that support

- production and cost efficiency
  (*mechanical* operating and knowledge environment)
- adaptive development and collective learning
  (*organic* operating and knowledge environment)
- innovation and new opportunities
  (*dynamic* operating and knowledge environment).

The DIC framework brings a new dimension to the way that statistical materials are used and handled. According to this framework genuine renewal and competitiveness are produced not only by separate component factors, but above all by high-level operating and knowledge environments. These refer not only to social structures, but to the dynamics of the operating environment.

- Mechanical (physical or institutional) structures that provide stability and cost effectiveness
  - Criteria: Reliable and advanced infrastructures
  - Outcome: Sustainability, efficiency
  - Competitive advantage: Asset based
- Organic (social and organizational) structures that allow for flexible adaptation in society to national and international changes[13]
  - Criteria: Global, national and regional integration and cooperation

[11] Also known as the knowledge environment theory. For details, see Ståhle & Grönroos 2000 and Ståhle et al. 2003. There are also points of similarity with Naumanen 2004.

[12] So far empirical applications of the DIC model or knowledge environment theory have been confined to the organizational level.

[13] Not only regional competitiveness but national development is always dependent on contexts and active interaction as well as related learning. National competitiveness is thus materialized in economic, political and cultural contexts, such as

–bilateral and unilateral economic treaties, trade unions and trade embargos (economic)

–sanctions by the UN, EU or a single country, international monetary policy, e.g. IMF (political)

–R&D collaboration or non-collaboration, exchange of information and technology etc. (cultural)

    - Outcome: Adaptive renewal
    - Competitive advantage: Action based
- Dynamic (forward-looking and creative) structures that support innovation and creative economy
    - Criteria: High level of human capital, structures and strategies for innovation
    - Outcome: Radical renewal
    - Competitive advantage: Strategy based

The DIC theory rests on the assumption that the achievement of lasting competitive advantage requires that all knowledge environments are operational. The core lies in national *renewal*, which is necessary for the achievement of competitive advantage over and again in a globally changing situation.

In the EIS foresight model, the statistical material is organized and analysed according to these three operating environment criteria. This makes it possible to form an overall impression based on the impact of different indicators on different operating environments.

At the same time, *the model helps to identify strengths and weaknesses as well as growth and threat factors that would remain hidden if unclassified indicator data were used.*

The hypothesis in the EIS model is thus that national intellectual capital grows out of the efficient operation of these three operating environments and their mutual dynamics (= dynamic intellectual capital). A separate method has been developed for describing dynamic intellectual capital at the organizational level (KM-factor®[14]), but that method cannot be used to analyse national intellectual capital because it does not make use of statistical data. Nonetheless its basic principle is certainly applicable: in the EIS foresight model statistical indicators are classified according to how they describe different operating environments.

Operating environment	**Mechanical Infrastructure Core functions**	**Organic Networking Integration**	**Dynamic Development Innovation**
Statistical variable(s)	←	Appropriate statistics, statistical indicator or composite index i	→

Figure 5. Operating environments supporting the formation of intellectual capital and competitive advantage.

[14] For s scientific description of the instrument, see Ståhle et al. 2003.

2.3 Integration of competitiveness and intellectual capital

Comparisons of competitiveness and intellectual capital use similar statistical sources to describe national competitiveness or intellectual capital. It is noteworthy, however, that although the variables and categories of variables may be the same, the emphasis varies. In an assessment of competitiveness, the main emphasis is on economic indicators, where intellectual capital is concerned the accent is on indicators describing technological development. Both emphasize indicators that describe technological development.

In a global business environment the conditions for competitiveness vary according to international changes, tangible and intangible national capital and the potential to take advantage of the opportunities available. In the EIS foresight model, competitiveness is understood as a capability based on dynamic intellectual capital.

There exists no single formula for the measurement of national competitiveness, but every analysis is context-dependent and linked with the nations

- assets
- actions
- strategies

and covers a nation's achievements within

- business and economy
- society, politics and environment
- culture, education and intellectual capital

and their connectedness on

- global
- national
- regional levels.

2.4 Competitiveness and foresight

Continuing competitiveness is always based on renewal. A competitive edge today will not necessarily be one tomorrow. Without constant renewal, old competitive advantages can easily be lost. Secondly, it is noteworthy that the competitive advantage of advanced countries in the global economy is largely based on intellectual capital. Here, an overly static understanding of knowledge and intellectual capital is bound to be misleading. It is important to recognize that knowledge is fundamentally a matter of flows and events and activities rather than facts or knowledge storehouses, and that people use and create new knowledge in favourable circumstances and environments. Knowledge reserves do, however, provide an important foundation for renewal, so it is not all a matter of dynamics.

The EIS foresight model must incorporate systemic factors, which are missing from the current intellectual capital models. The systemic factors include:

- Strategic factors
    - Even the best intellectual capital will remain useless if actions and inputs are not properly allocated. The EIS model takes account of strategic factors via the input of experts groups. The strategic aims of each foresight exercise determine the indicators that are used in expert panels or Delphi groups to summarize the key strategic conclusions.
- Country's position and linkages
    - The country's location and relationship with the environment influence the ways in which intellectual capital can be used.
    - The nation will only be able to use its intellectual capital if it is linked up with international knowledge and capital flows.
    - The above points are dependent on the country's ability to recognize its strategic position and to make good use of it in global competition.
- Systemic efficiency
    - The nation must constantly maintain its capability for renewal, which requires an orientation to advanced infrastructures, the capability for adaptive renewal as well as radical innovation. In the EIS model this is taken into account so that the indicator data are handled according to the classification of the knowledge environment theory.

Indicators of competitiveness or traditional measures of intellectual capital do not in themselves provide a sound enough basis for accurate future projections. Comparative indexes do not predict future success very well if the ultimate criterion for competitiveness is economic success as measured in terms of GDP. For example, countries that in the early 1990s ranked among the best performers in international comparisons of competitiveness, such as Germany and Japan, were by the end of the decade trailing far behind the world leaders. On the other hand competitiveness indexes do correlate quite closely with the

current situation of national economies, although there are exceptions. One example is Finland, which comes out on top in comparative analyses yet in GDP statistics ranks only 15th.

Organizational indicators of dynamic intellectual capital (using KM factor® analysis) seem to correlate very closely with future economic success.[15] At the national level these associations have not yet been tested.

Indexes of competitiveness and intellectual capital seem provide a sound enough basis for foresight exercises, but it is important to stress that we can draw no direct conclusions from these indexes. Competitiveness indexes are based on records of the immediate past. If they are complemented by dimensions of dynamic intellectual capital, there is reason to believe that the accuracy of forecasts will improve. In addition to this, the EIS foresight model must incorporate an indicator-based component that allows us to locate technological and environmental trends of change.

Figure 6 summarizes the framework for the EIS foresight model. It is built around three core components, i.e.

- analysis of global trends
- indicators of national competitiveness and analysis of renewal based on those indicators
- taking advantage of the country's strategic position and its links with global knowledge and capital flows (which is done through expert groups; this is discussed in more detail in Chapter III below).

[15] Pöyhönen, A., Ståhle, P. & Ståhle,S. 2004

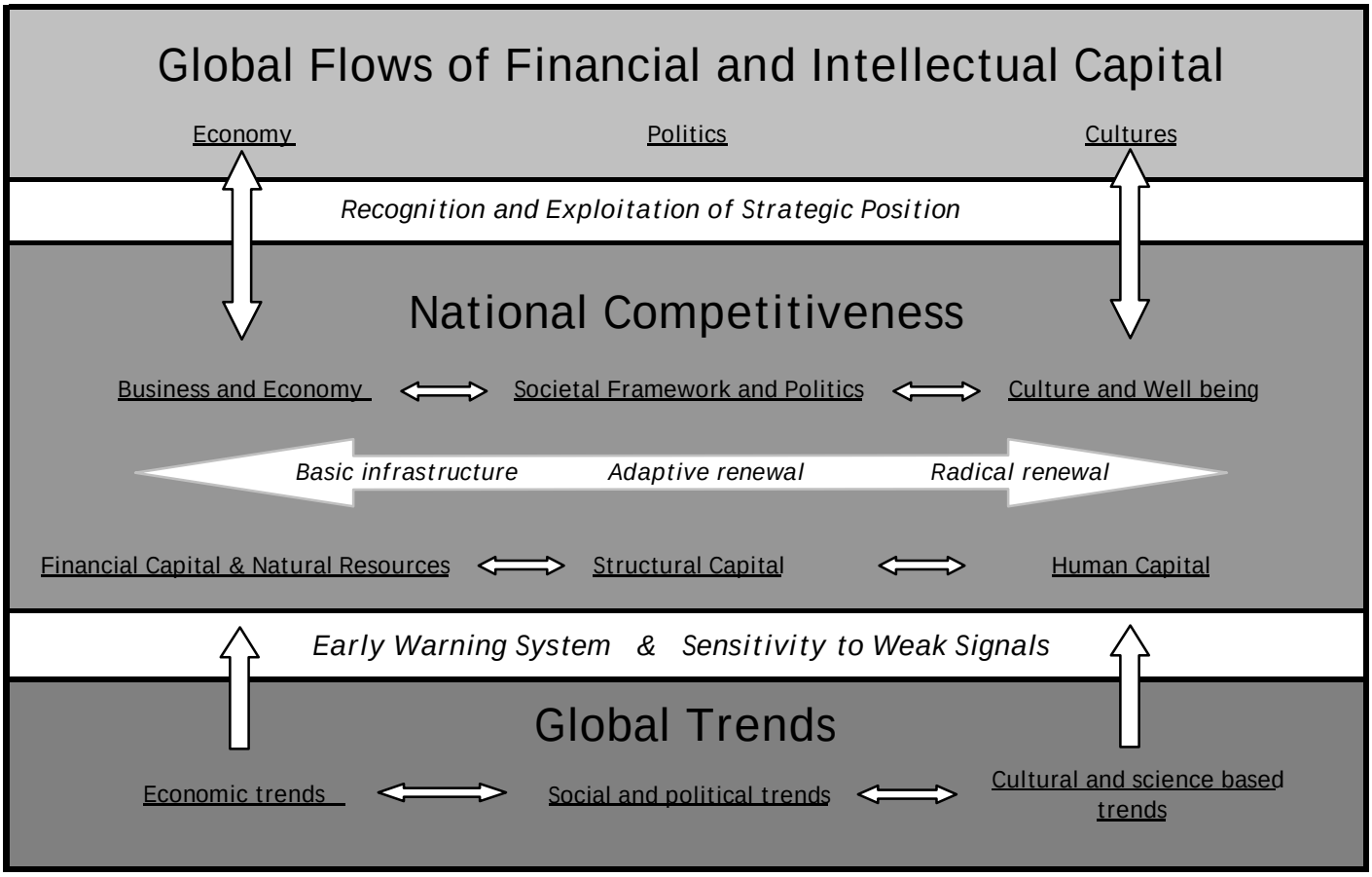


Figure 6. Framework for EIS foresight model.

The main components of the model are shown in boldface. Functions requiring analysis are in *italics*. Statistical indicator sources are underlined.

Not all components in the EIS foresight model have the same weight and value, but different factors are weighted according to the global or national situation. In the current knowledge-intensive market economy, the success of advanced countries depends upon economic factors and intellectual capital. However, this has not always been the case, nor will it necessarily always be the case. In the past, the main competition factors were entirely different, and indeed in some countries natural resources remain the principal factor even today. Figure 7 illustrates the role of this weighting: competitive advantage is based on human capital, but the most critical factor in competition is how to put that capital to good use.

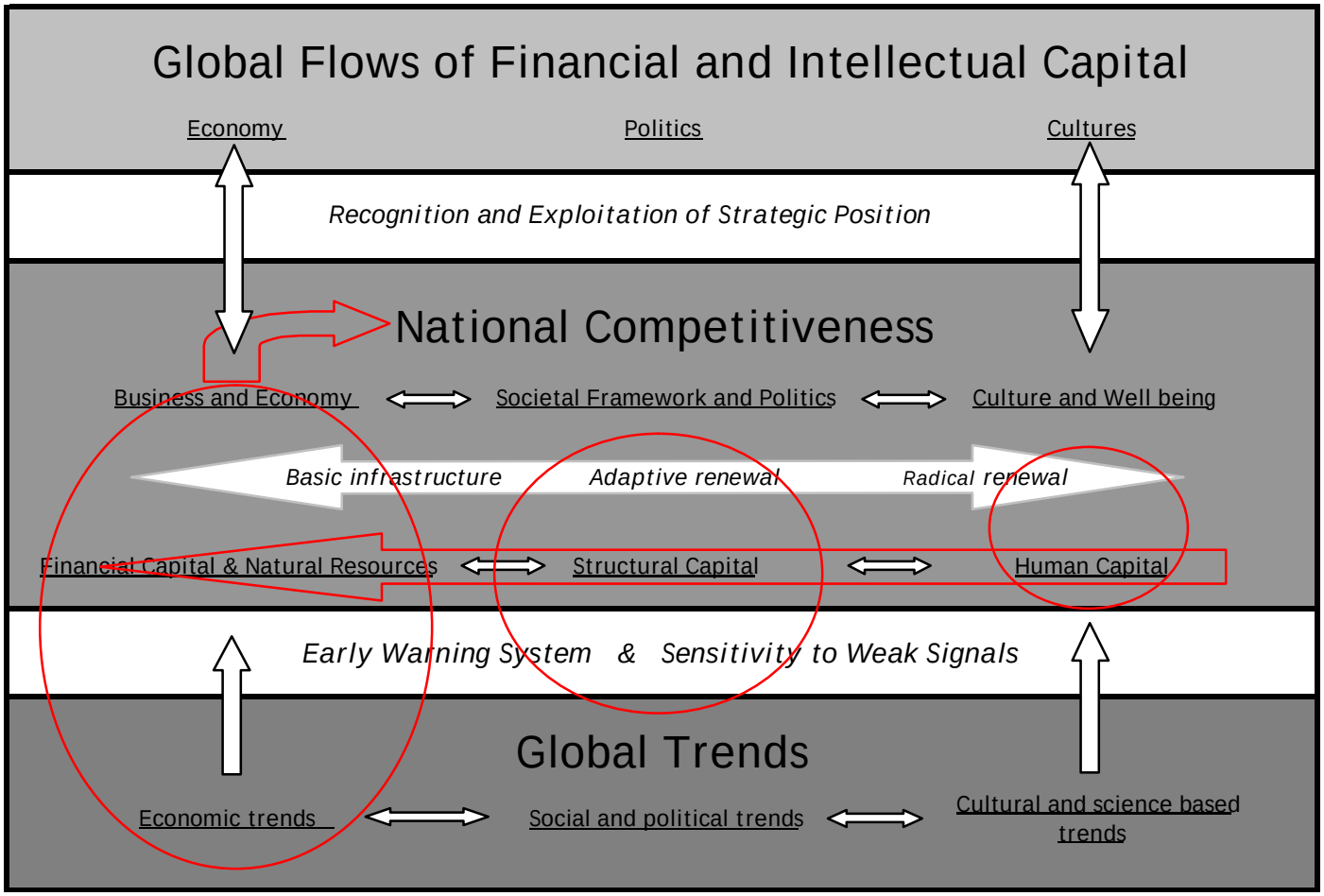


Figure 7. Market economy emphasis on national competitiveness.

3. FORECASTING EDUCATION AND QUALIFICATION NEEDS: A PRACTICAL APPLICATION OF THE EIS FORESIGHT MODEL

The general structure and theoretical underpinnings of the EIS model provide a good foundation for developing either a simple tool for practical foresight purposes or a more sophisticated model that requires background research and/or dedicated software. The latter is the recommended option because the EIS model includes a host of features that can help to improve the methods and results of foresight exercises. Some of the principles outlined in this report can be quite easily put to practical use. This third chapter of our report introduces a simple practical application of the EIS foresight model that does not require substantial investment in resources or separate software. The weakness of this tool is that it does not take advantage of all the criteria and possibilities described in the theoretical part.

3.1 Premises for practical application of EIS model

Our practical EIS foresight model is grounded in the EIS framework that identifies the main indicator categories used (Figure 6). The terms underlined in Figure 6 are based on statistical indicators that have been selected from suitable statistical sources. The practical EIS model can make use of all international comparisons that include ranking data (IMD, WEF, EU etc). The application of these data in the EIS model significantly increases both their use value and information value.

In the practical application described here, rankings are assessed in six main classes, which integrate indicators of competitiveness, intellectual capital and social development. In Figure 6 these main classes are underlined. Behind them, we find the following international comparative data:

- Business and Economy
- Societal Framework and Politics
- Culture and Well-being
- Financial Capital & Natural Resources
- Social and Structural Capital
- Human Capital

The early warning system (EWS) and sensitivity to weak signals of changes (SWS) are analysed in three trend categories (which are underlined in the lower section of Figure 6):

- Economic trends
- Social and political trends
- Cultural and technological trends

EWS and SWS analyses are focused on separately targeted areas. These are chosen depending on each situation, and they are based on factors that are important to current national competitiveness (e.g. in Finland the current ICT sector or forest industry).

The model incorporates three operating environments to describe the country's development (the middle zone in Figure 6). The indicators describing past development or current situation are obtained by arranging the ranking values according to these three operating environments:

1. Advanced Infrastructure
2. Capability for Adaptive Renewal
3. Potential for Radical Renewal

3.2 Indicator selection criteria and classification

The primary material consists of international ranking indicators. A suitable source (e.g. IMD) is first selected for each area of the model (Figure 6). Only the strongest and weakest ranking values are used, say the 10 highest and 10 lowest values. The weight and significance of the ranking indicators must be assessed against both their content and sample size. For instance, 50th is a poor ranking if the comparison involves 60 countries (IMD), but average of there are 104 (WEF). The problem can be controlled in one of two ways:

- Only those ranking indicators are included in the comparison that are drawn from the same or similar-sized source groups.
- Rankings are converted into percentages (for more details, see Processing indicators below).

IMD and WEF rankings, for example, are not directly comparable. In order that different indicators can be entered in the model, we must also consider

- which main class they belong to
- which operating environment they belong to.

Table 3. Framework for practical EIS foresight model.

EIS application				
Competitiveness Social development Intellectual capital		IMD rankings		
IMD variables Allocation of variable to appropriate operating environment				
Operating environments		Mechanical Infrastructure Core functions	Organic Networking Integration	Dynamic Development Innovation
Selection criteria - 5 strongest/ weakest - all classified		Basic infra-structures	Capability for adaptive renewal	Potential for radical renewal
			Operating environments	
Rankings				
Business and Economy Societal Framework and Politics Culture and Well-being Financial Capital & Natural Resources Social and Structural Capital Human Capital		Main categories		
Trends				
Economic trends Social and political trends Cultural and science based trends				

The indicators cannot be mechanically entered into the Table. The choice of operating environment must be based on the criterion of how the variable measured by the indicator strengthens or weakens

- the social and economic infrastructure
- adaptive renewal in society and the economy
- innovation and the potential for radical renewal

In addition, the decision must be made on the *general selection criterion* for the EIS table:

- how many of the strongest/weakest rankings for each main class shall be included (e.g. 5 strongest and 5 weakest)
- should all rankings be included in the Table
- other criterion (e.g. inclusion of average rankings).

The selection criterion may be described as a telescope that is used to focus in on the whole mass of indicators.

3.3 Processing indicators

The ranking values are entered into the Table according to the chosen selection criterion and the classification. In the example below (Table 4), the five strongest and five weakest indicators of the IMD's Business and Economy category have been entered in the EIS table:

- the indicators are shown in the left hand side column
- IMD rankings allocated to the three operating environments are shown on the top line

Table 4. Example: Strongest and weakest rankings for the Finnish Business and Economy category according to IMD[16].

		Advanced infra-structure	Capability for adaptive renewal	Potential for radical renewal
Entered in EIS model / Strengths				
Business and Economy				
GDP per capita		**15**		
Consumer price inflation			**3**	
Current account balance (% of GDP)			**12**	
Direct investment stocks inward - real growth			**14**	
Relocation of services (not threat to economy)				**6**
Entered into EIS model / Weaknesses				
Business and Economy				
Direct investment flows abroad (% of GDP)				**59**
Direct investment flows abroad US$ billion				**59**
Employment - growth estimates (% change)		**53**		
Employment		**50**		
GDP (PPP) Estimates			**49**	

The Table highlights Finland's strengths and weaknesses, and furthermore shows how they are accumulated (number in each column). It is clear from the example that capability for adaptive renewal is one of Finland's strengths: three indicators out of five are strong. The same conclusion is supported by weaknesses: just one weak indicator out of five falls in the column of Adaptive renewal. By contrast Finland's potential for radical renewal seems rather weak in the light of this example: just one strong indicator out of five is listed under this column. On the other hand two out of five indicators appear as weaknesses in this column.

To further illustrate this result, the strengths and weaknesses can be converted into percentages:

Percentage strength (strongest=100) is calculated from the formula:

$$RankingS(\%) = (Sample + 1 - Ranking)*(100/Sample)$$

Percentage weakness (weakest =100) is calculated from the formula:

$$RankingW(\%) = (Ranking)*(100/Sample)$$

IMD 60 countries in sample

WEF 104 countries in sample

[16] Finland's IMD data are used as an example in all the following tables.

In Table 5, the rankings shown above are converted into percentages.

Table 5. Example: Strongest and weakest rankings for the Finnish Business and Economy category according to IMD, percentages.

		Advanced infrastructure	Capability for adaptive renewal	Potential for radical renewal
Entered in EIS model/ Strengths				
Business and Economy	**Strength %**	**18**	**60**	**21**
GDP per capita		**76**		
Consumer price inflation			**96**	
Current account balance (% of GDP)			**81**	
Direct investment stocks inward - real growth			**78**	
Relocation of services (not threath to economy)				**91**
Entered in EIS model/ Weaknesses				
Business and Economy	**Weakness %**	**38**	**18**	**43**
Direct investment flows abroad (% of GDP)				**98**
Direct investment flows abroad US$ billions				**98**
Employment - growth estimates (% change)		**88**		
Employment		**83**		
GDP (PPP) Estimates			**81**	

At the same time, the Strength % and Weaknes s% rows indicate the occurrence of strengths and weaknesses in the Business and Economy area by operating environment (figures indicated in red). The strength/weakness for the whole area (e.g. Business and Economy) is obtained from the formula:

Strength/Weakness (%)=Sum(Column S)*(100/Sum(All))

In this example the analysis of strengths and weaknesses leads to the same conclusion.

Business and Economy

Operating environment	Strength %	Weakness %
Advanced infrastructure	18	38
Capability for adaptive renewal	60	18
Potential for radical renewal	21	43

Finland's economic strength lies in its capability for adaptive renewal, our weakness in turn is to be found in our infrastructures and our potential for radical renewal. The major infrastructure threat, in the light of the sample analysed here, is presented by the small size of the active labour force.

3.4 Processing trends of change

Time series of ranking indicators also provide a way for us to monitor trends. At Level 1, this can be done by observing the development of Finnish rankings within a certain time span. The example below (Table 6) shows that Finland's anticipated ranking in 2006 is 7th.[17] The reliability of this forecast is indicated in the WEIGHT column, which is determined by the regularity in the variation of the ranking during the time span under review. In our example reliability varies within the range of 0–5, with 5 indicating the highest reliability

Table 6. Example: Trend table based on time series (Finland's rankings/IMD).

Finland	**2001**	**2002**	**2003**	**2004**	**2005**	**TREND**	**WEIGHT**
Overall ranking	5	3	3	8	**6**	**7**	**2**
Economic Performance	34	25	30	31	**32**	**31**	**3**
Government Efficiency	3	1	1	4	**3**	**3**	**2**
Business Efficiency	4	3	2	10	**9**	**11**	**2**
Infrastructure	4	3	4	7	**4**	**6**	**3**

At Level 2, trends can be monitored as shown in the example below. In Table 7 we have entered all Finnish rankings from the IMD's 2005 competitiveness report. The Table includes all the main classes (1–4) used by the IMD as well as their subcategories (1–4), rank ordered according to the Finnish situation. Table 7 shows the foundation for Finland's strengths in each situation (all indexes that are above the general level count as our main strengths, regardless of the ranking of individual indexes). On the right hand side of Table 7, we have calculated the trend values for all the individual areas and they have been rank-ordered. This allows us to see at one glance which strength areas are at risk of declining (in this case Management Practices). It would seem that Finance and Business Efficiency is marginally improving, even though the trend indicates that its true ranking is on the decline. Table 7 shows in red those indicators whose trend projections have a high reliability: Attitudes and Values, Domestic Economy and International Investment, International Trade and Employment. In other words, in the light of this sample, Finland's weak situation in these areas looks set to continue.

[17] The trend value is calculated using ordinary linear regression.

Table 7. Example: Trend analysis based on second-level time series.

CLASS		PERIOD					CLASS		TREND	WEIGHT
	National Competitiveness Structure 2005	**2001**	**2002**	**2003**	**2004**	**2005**		**National Competitiveness Structure forecast**		
4	Education	2	1	1	1	**1**	4	Education	**1**	**0**
2	Societal Framework	4	1	1	1	**2**	2	Societal Framework	**1**	**1**
3	Management Practices	1	2	1	6	**2**	2	**Government Efficiency**	**3**	2
2	Institutional Framework	2	2	1	4	**3**	2	Institutional Framework	**4**	3
2	**Government Efficiency**	3	1	1	4	**3**	2	Business Legislation	**4**	2
2	Business Legislation	4	3	3	6	**3**	3	Management Practices	**4**	2
4	**Infrastructure**	4	3	4	7	**4**	4	**Infrastructure**	**6**	3
	Overall Ranking	**5**	**3**	**3**	**8**	**6**		**Overall Ranking**	**7**	**2**
4	Health and Environment	8	8	10	16	**6**	4	Scientific Infrastructure	**9**	3
4	Scientific Infrastructure	7	6	9	10	**7**	3	Finance	**10**	3
3	Finance	6	6	5	10	**9**	3	**Business Efficiency**	**11**	2
3	**Business Efficiency**	4	3	2	10	**9**	4	Health and Environment	**11**	2
3	Productivity & Efficiency	12	21	16	15	**9**	3	Productivity & Efficiency	**11**	2
2	Public Finance	9	11	8	10	**12**	2	Public Finance	**12**	3
3	Attitudes and Values	5	7	4	11	**15**	3	Attitudes and Values	**16**	**4**
4	Technological Infrastructure	4	3	3	11	**15**	4	Technological Infrastructure	**16**	3
1	Prices	39	19	22	35	**17**	1	Prices	**18**	3
4	Basic Infrastructure	16	14	18	21	**17**	4	Basic Infrastructure	**20**	3
1	Domestic Economy	15	21	16	19	**20**	1	Domestic Economy	**21**	**4**
3	Labour Market	7	14	3	22	**28**	1	International Investment	**28**	**4**
1	International Investment	20	15	30	11	**32**	3	Labour Market	**30**	2
1	**Economic Performance**	34	25	30	31	**32**	1	**Economic Performance**	**31**	3
2	Fiscal Policy	30	31	27	37	**36**	2	Fiscal Policy	**38**	3
1	International Trade	29	38	43	41	**44**	1	International Trade	**49**	**4**
1	Employment	34	34	41	46	**51**	1	Employment	**55**	**4**
	Average	**12**	**11**	**12**	**15**	**15**		**TREND**	**16**	**2,7**

Table 7 clearly highlights the trends that are on the decline. We can gain a more accurate impression of those trends by examining the statistical sources underlying the rankings.

At Level 3, we can continue to elaborate by incorporating EWS and SWS analysis. For this we need to select a specific target of analysis and a related set of variables from the rankings material. The aim is to locate trends that can be interpreted as either positive signals or early warning signs. The trend series can be analysed by operating environment, for instance, which will bring out weaknesses and strengths related to those operating environments.

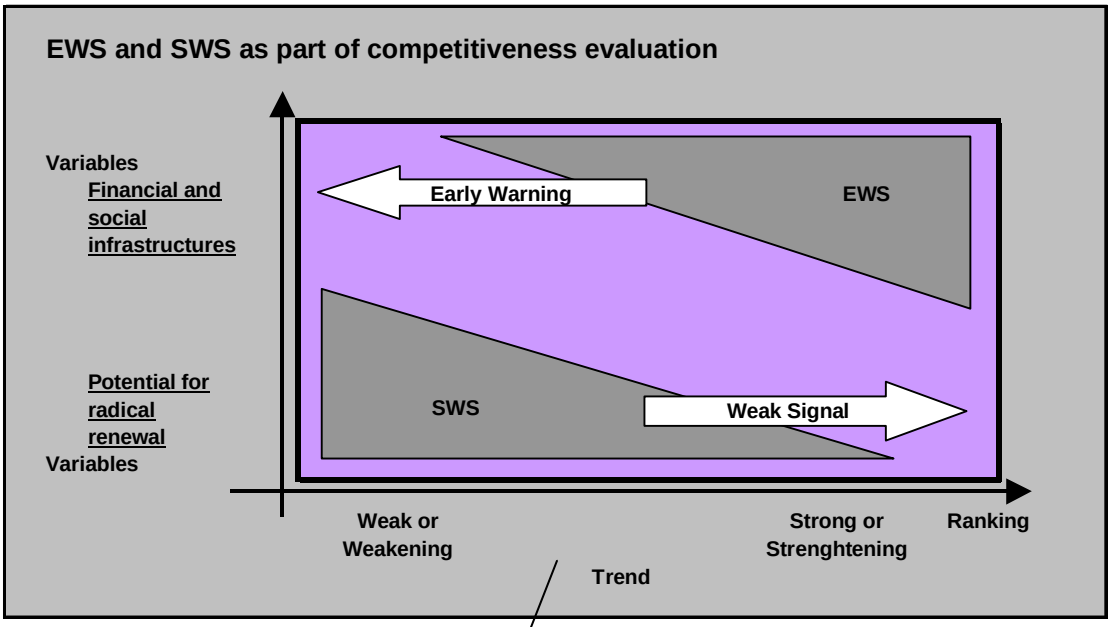


Figure 8. Monitoring the competitiveness of operating environments through EWS and SWS.

Table 8. An example: A third level trend analyses combined with SWS analyses (Finland's data / IMD 2005).

Business Efficiency							
Attitudes and Values	**PERIOD**					**TREND**	**WEIGHT**
Criteria (Values)	**2001**	**2002**	**2003**	**2004**	**2005**		
Attitudes toward globalization (Survey)	7,56	7,43	7,19	6,83	**6,46**	**6,26**	**4**
Attitudes toward globalization are generally positive in your economy							
Image abroad (Survey)	8,32	8,18	8,22	8,15	**7,61**	**7,66**	**3**
The image abroad of your country/region encourages business development							
National culture (Survey)	6,84	7,39	7,37	6,78	**7,15**	**7,11**	**2**
National culture is open to foreign ideas							
Flexibility and adaptability (Survey)	7,63	7,74	7,62	7,23	**6,85**	**6,80**	**3**
Flexibility and adaptability of people in your economy are high when faced with new challenges							
Need for economic and social reforms (Survey)	na	na	na	6,52	**5,93**	**5,34**	**1**
Need for economic and social reforms is generally understood by people in your society							
Values of society (Survey)	8,27	8,08	7,92	7,38	**6,41**	**6,28**	**4**
Values of society support competitiveness							
Corporate values (Survey)	na	na	na	na	**7,11**	**7,11**	**na**
Corporate values take sufficiently into account the values of employees							

The example in Table 8 monitors variables that strengthen the potential for radical renewal under the index category of Business Efficiency/Attitudes and Values. On the basis of the analysis presented earlier, this trend is sharply declining in Finland and the forecast suggests that this trend is set to continue and cause concern in the future. This is an internal weakness that is affected not only by Finland's ranking

(because the values used here are Finnish indicators used to determine rankings). The Table shows that all indicator values for Attitudes and Values are declining with just one exception, i.e. that of Image abroad.

3.5 Example of monitoring market areas

SWS and EWS are purpose-designed models in which

- SWS identifies weak positive trends of change
- EWS warns about negative trends of change.

In our practical application that focuses on analysing rankings, the SWS and EWS systems are used according to the following principles:

- EWS monitors *strengths that are beginning to weaken*. In this sense a drop from third to fifth ranking is a worrying sign; it should be identified and it should prompt immediate reaction.
- SWS monitors *weaknesses that are beginning to show signs of positive change.* For instance, moving up from 54th to 51st ranking may be an indication that the measures taken have started to have the desired effect.
- A marginal positive change in a very strong ranking is not a weak signal. For example, moving up from third to second place is not dramatic enough to warrant attention.
- A marginal negative change in a very low ranking is not an early warning sign. There is nothing dramatic in dropping down from 54th to 56th place.

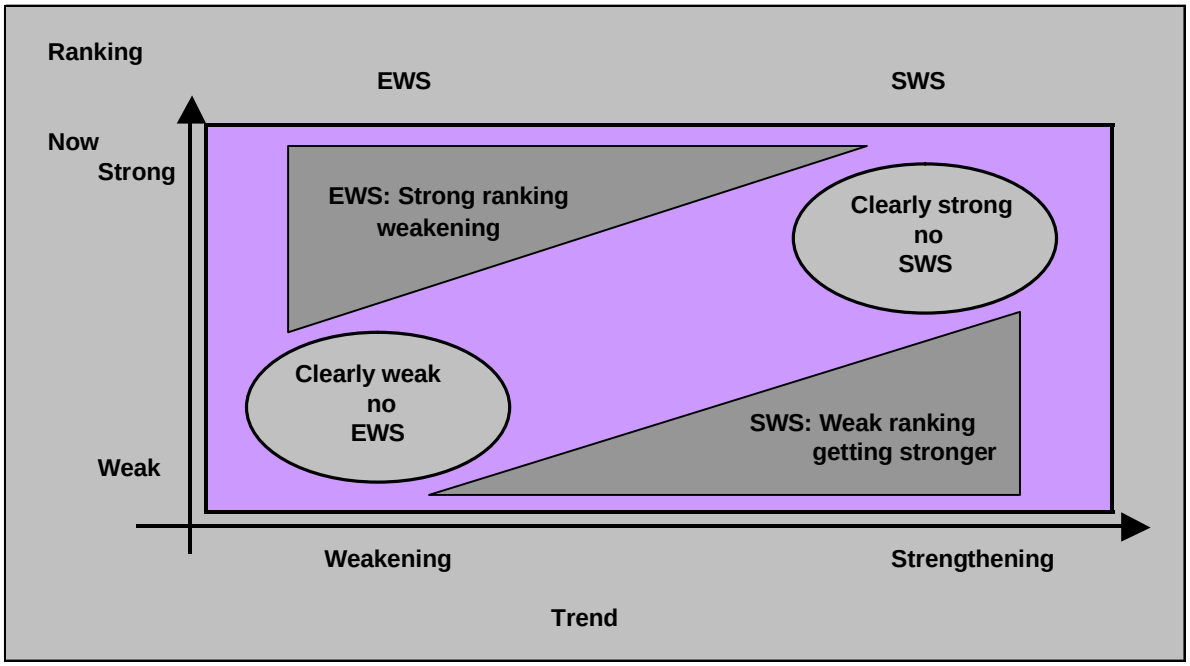


Figure 9. SWS and EWS analysis based on rankings.

The following provides an example of an EWS application focusing on Russia as a growing market area. Figure 10 illustrates the basic logic of EWS that can be used to analyse any market area. The basic structure revolves around three basic questions that are addressed by means of trend monitoring.

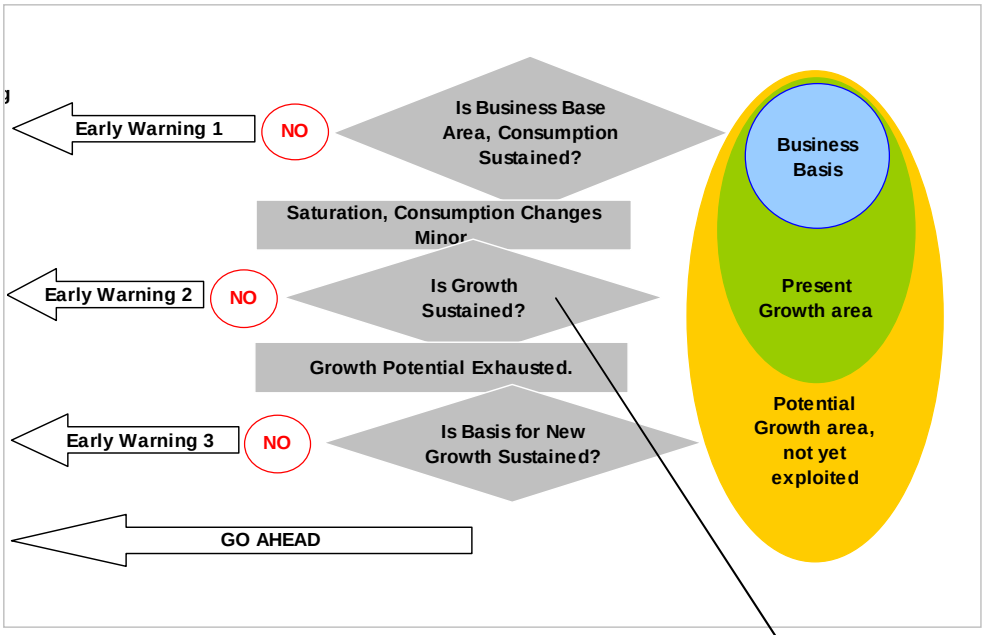


Figure 10. Basic logic of EWS analysis.

Table 9. Example: EWS analysis applied to market area monitoring.

Russia	2001	2002	2003	2004	2005	TREND	WEIGHT
Overall Ranking	43	44	54	50	**54**	**57**	4
Economic Performance	41	41	52	54	**57**	**63**	4
Government Efficiency	45	44	52	40	**46**	**45**	**2**
Business Efficiency	47	43	56	52	**55**	**58**	**3**
Infrastructure	37	35	47	43	**46**	**49**	**3**

A calculation of the trends in development in Russia (according to IMD sources) shows that the continued growth of purchasing power involves risks (Table 9). For example, there is the risk that too much purchasing power will be concentrated in too few hands, because the trends indicate that at the national level, purchasing power will not increase. In this example all indicators point at a declining trend for Russian competitiveness.[18]

Using ranking indexes for EWS and SWS analysis is an extremely simplified method, however, and needs to be tested in practice to ascertain its validity. The method may yield some information for

[18] It is important to bear in mind, however, that this is a rather crude example based on a limited dataset. It does not provide a solid enough basis for any firm conclusions, but it does suggest a need for further analysis.

foresight purposes, but that information certainly requires further processing using the methods outlined earlier. In addition, it is noteworthy that the examples above are based on minimal data and primarily describe the method rather than the results.

3.6 Processing of results

The percentage results for all areas can be illustrated by compiling them in an EIS summary table. (The figures shown are percentages and are based on Table 5 above).

Table 10. EIS summary table.

Summary of strengths				
		Basic infra-structure	**Adaptive renewal**	**Potential for radical renewal**
Strengths				
Business and Economy		**18**	**60**	**21**
Societal Framework and Politics		**...**	**...**	**...**
Culture and Well-being		**...**	**...**	**...**
Financial Capital & Natural Resources		**...**	**...**	**...**
Social and Structural Capital		**...**	**...**	**...**
Human Capital		**...**	**...**	**...**
Rising trends				
Economic trends		**...**	**...**	**...**
Social and political trends		**...**	**...**	**...**
Cultural and science based		**...**	**...**	**...**
Summary of weaknesses				
		Basic infra-structure	**Adaptive renewal**	**Potential for radical renewal**
Weaknesses				
Business and Economy		**38**	**18**	**43**
Societal Framework and Politics		**...**	**...**	**...**
Culture and Well-being		**...**	**...**	**...**
Financial Capital & Natural Resources		**...**	**...**	**...**
Social and Structural Capital		**...**	**...**	**...**
Human Capital		**...**	**...**	**...**
Weakening trends				
Economic trends		**...**	**...**	**...**
Social and political trends		**...**	**...**	**...**
Cultural and science based		**...**	**...**	**...**

The Table can easily be processed further for instance by calculating Finland's strengths and weaknesses by *operating environment* (by column) and by *main areas* (by row).

The EIS summary table offers an illustrative source of information on prevailing trends, strengths and weaknesses that should be taken into account in all social decision-making. In this regard the EIS model serves as a general foresight tool.

For purposes of forecasting changes in education, skills and qualification needs, the results of the EIS analysis must be linked with individual industries and economic clusters. This is done by arranging industries in a matrix whose dimensions are the main classes of competitiveness[19]and operating environments[20] as presented in the EIS model. The current skills and competence structure in industries or clusters is analysed using the matrix variables. For example, the forest and wood industry is highly capital-intensive, dependent on natural resources and basic skills and competencies. Only a small proportion of the labour force in the industry has a higher education: the most crucial factors are infrastructure and the operation of core functions. In our matrix (Figure 11) the forest and wood industry is therefore placed close to infrastructure, economic/financial capital and natural resources. The small Table added at the bottom of the Figure shows that the weaknesses and strengths of the corresponding area produce risks for this industry (based on the EIS analysis, see Table 5 on page 32). The competitiveness of the industry can only be maintained if existing risks are properly addressed, including measures to develop education, skills and competencies.

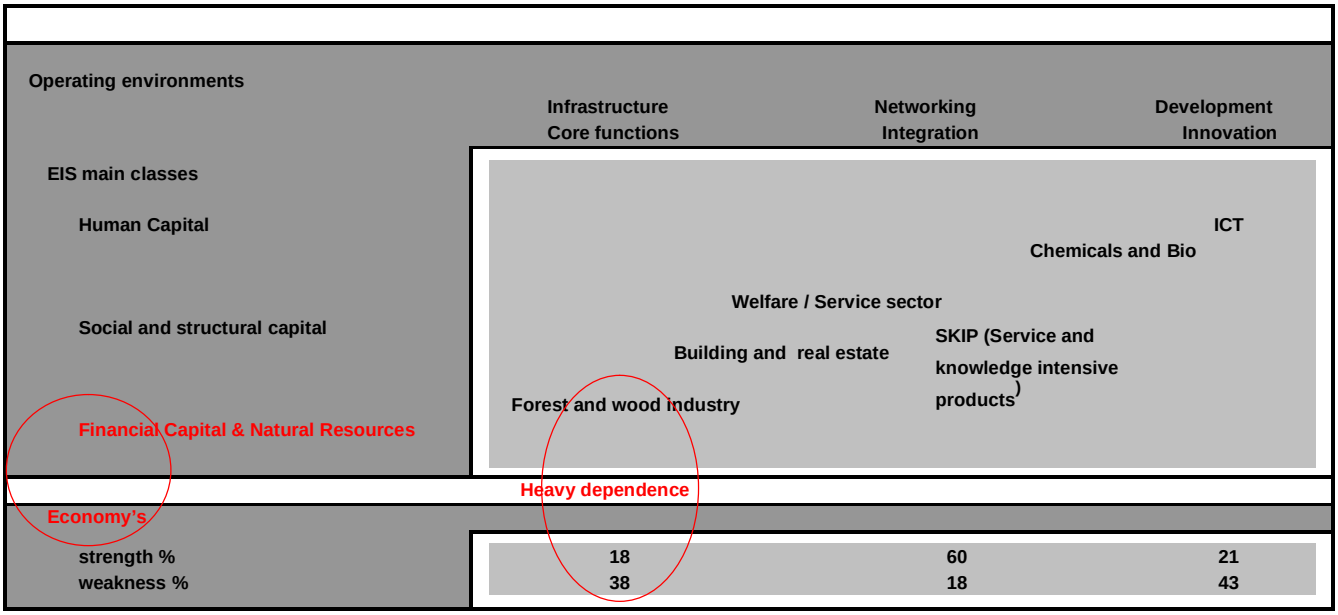


Figure 11. Example: Location of economic clusters in the matrix of EIS main classes and operating environments.

In order that we can proceed to accurately determine education, skills and qualification needs, we also need to analyse the industry ś internal dynamics. For this we need to

- analyse rising and declining trends within the industry using the EIS principles outlined in this report;
- education, skills and qualification needs are determined in such a way that
  - current strengths can be maintained
  - rising trends can be strengthened

[19] Business and Economy, Financial Capital and Natural Resources, Societal Frameworks and Politics, Social and Structural Capital, Human Capital, Culture and Well-being

[20] Basic Infrastructure, Adaptive Renewal, Radical Renewal

Education, skills and qualification needs are determined on the basis of both general trend factors and the industry's own internal competitiveness. In the long term the most determining effect is exerted by general trends.

3.7 Application of EIS model based on expert work

The EIS foresight model is largely based on the use of statistics that are useful for broadly-based foresight purposes. The forecasting of education, skills and qualification needs is always based on global trends whose impacts cut across all areas of society. On the other hand, when political decisions are made in the area of education, skills competencies, it is essential that decision-makers have access to accurate statistical information on the current situation in the country. The identification of training and education needs is always grounded not only in economic but also cultural factors, which in the final analysis must be considered in the light of national competitiveness. Every country must develop its skills and competencies in such a way that it can find its own niche in the global competition and in the long term enhance the welfare and well-being of its citizens.

Accurate information about the development of industries and economic clusters and their skills and competence needs is of vital important to informed decision-making on education policy. This report offers no concrete examples of industry-specific analyses, but only demonstrates the need for such analyses and provides some guidelines on how those analyses should be conducted. The further development of the EIS system for this purpose remains a challenge for future research.

However, if it is combined with the use of experts and expert opinion, the EIS model can in fact be used even without extensive further development, on the basis of the principles outlined in this report. This would involve the appointment of, say, two groups of experts to take charge of the foresight exercise. The first group would consist of national opinion leaders and/or industry representatives with a strong preliminary understanding of ongoing trends of change internationally or within their industry sector. Following the principles of EIS analysis, this group is supplied with material on global trends. The group then proceeds to refine this information either in discussion fora or by means of Delphi questionnaires, or both. This will help to provide a more diverse and detailed background to the causes and consequences of the hard statistical facts as well as information on what kind of thought models and interpretations inform the thinking of experts and decision-makers. The main role of the group is to debate the strategic significance of the trend and statistical sources and to draw strategic conclusions.

The second group would consist of education experts and decision-makers. They are given the results of both the EIS analysis and the strategic conclusions drawn by national experts and decision-makers. Furthermore, they would also have access to forecasts and analyses concerning different industries. The group could summarize its work either in discussion fora and/or Delphi working groups.

Expert groups have a key role to play in drawing both strategic and operative conclusions. The EIS model is based on the use of trends and indicators, but the influence of these materials on the nation's strategic position-taking and its ability to link up with international knowledge and capital flows depends upon a dialogue between experts and decision-makers. Likewise, it is imperative that the statistical sources used are combined with the use of expert knowledge so that the EIS model can be effectively applied for purposes of operative decision-making on new training openings or fields of education, for instance.

Even if the main emphasis in developing the EIS foresight model is placed upon the systematic use and analysis of statistics, it is important to complement and interpret the results obtained with this model by means of experiential sources of information. Human debate and discussion and tacit expert knowledge have a crucial part to play in every foresight exercise.

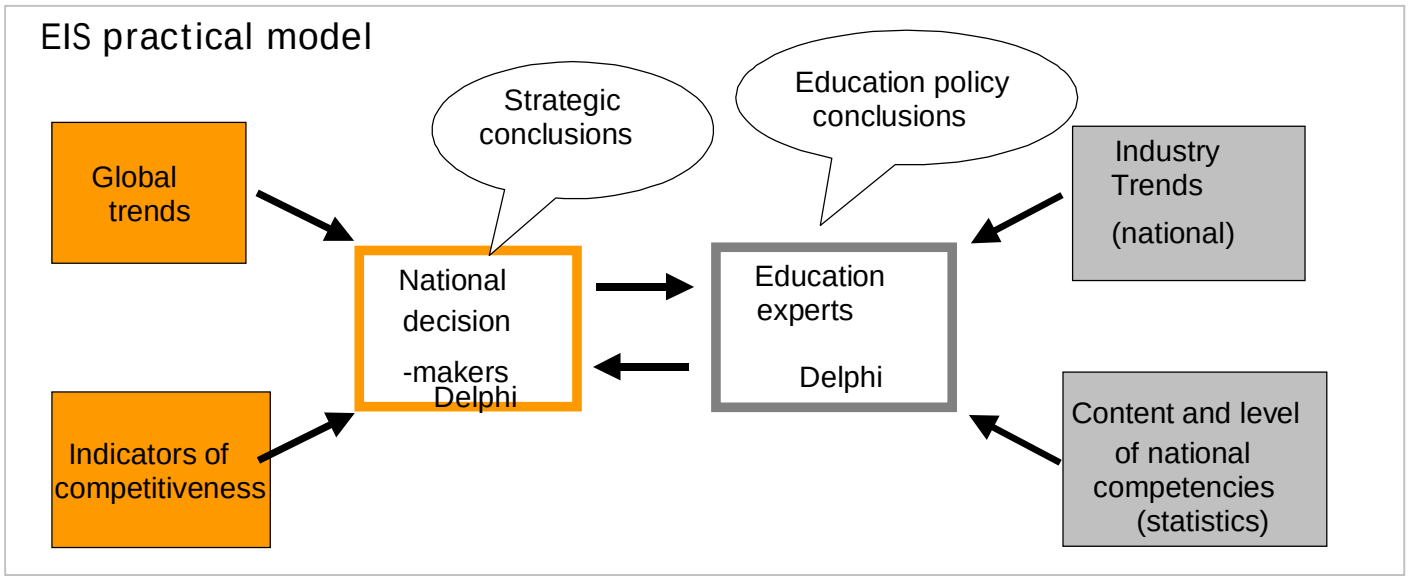


Figure 12. Educational Intelligence System: a practical model.

LIST OF REFERENCES

Literature

Aaltonen M & Barth T, How Do We Make Sense of the Future? –Analysis of Futures Research Methodology –V2.0, Finland Futures Research Centre / SINTEF, Norway. 2004. http://www. tse.fi.

Ahlqvist T, Avainteknologiat ja tulevaisuus. Yhteiskunnallisia tarkasteluja nousevien teknologioiden ja kvalifikaatioiden yhteyksistä. Opetusministeriön julkaisuja 2003:2.

Andriessen D, "The financial values of Intangibles ", World Congress of Management of Intellectual Capital, Ontario, 2002.

Ansoff I, Managing Strategic Surprise by Response to Weak Signals. California Management Review, Vol. XVIII, No. 2, 1975.

Barth T, The Role of Human and Social Capital –Complex Issues Raised by the OECD. SINTEF, Living Knowledge & Kunnskaping, N0102, 2001.

Bell W, Foundations of futures studies 2 vols. Transaction Publishers, New Brunswick and London, 1997. ISBN 1-56000-271-9 and 1-56000-281-6.

Bell D, The coming of post-industrial society: a venture in social forecasting. Basic Books, New York 1973.

Bontis N, (Ed), World Congress on Intellectual Capital Readings, Boston, Butterworth Heinemann, 2002.

Bontis N, Intellectual Capital: An exploratory study that develops, measures, and models. Management Decision, 36/2, 1998.

Bounfour A, Assessing performance of European innovations systems: An intellectual capital indexes perspective, In A. Bonfour & L. Edvinsson (Eds.), Intellectual capital for communities. Elsevier, Oxford 2005.

Chaiton A & Paquet G & Roy J & Wilson C, The Schizophrenic Corporation: Corporate Governance in a Clustered World. A paper presented to The Competitiveness Institute, 3rd Annual Conference, Clusters in the New Millennium, Glasgow, Scotland, October 4-6, 2000.

Edvinsson L & Malone M S, Intellectual Capital: realizing your company's true value by finding its hidden brainpower. New York, Harper Business, 1997.

Garelli S, Competitiveness of nations: The Fundamentals. Professor at IMD, Director of the World Competitiveness Project, IMD, 2003.

Garelli S, Competitiveness of nations: The Fundamentals. Professor at IMD, Director of the World Competitiveness Project, IMD, 2005.

Gavigan J P and Scapolo F, Matching methods to the mission: a comparison of national Foresight exercises. Foresight 01(06): 495-517, 1999.

Glenn J C (ed), Futures Research Methodology. Washington, American Council for the United Nations – The Millennium Project, 1999. http://millenium-project.org.

Gershuny J I, After Industrial Society? The Emerging Self-Service Economy. Macmillan, London 1978.

Glenn J C, Introduction in Futures Research Methodology –V2.0. AC/UNU Millennium Project, New York 2003.

Glenn J C & Gordon T J, Futures Research Methodology –V2.0. AC/UNU Millennium Project, New York 2003.

Godet M, From anticipation to action –A handbook of strategic prospective. UNESCO, Paris 1993.

Godet M, Creating Futures –Scenario Planning as a Strategic Management Tool. Economica, London 2001.

Helanterä A & Ollus S-E, Why they, why not we? An analysis of the competitiveness of Finland and Russia. Sitra reports series 46. Edita, Helsinki 2004.

Howard and Stein-Hudson Associates & Parsons Brinckerhoff Quade & Douglas, Public Involvement Techniques for Transportation Decision-making, U.S, Department of Transportation Federal Highway Administration, Federal Transit Administration 1996.
http://www.fhwa.dot.gov/reports/pittd/cover.htm.

Inglehart R, Globalization and Postmodern Values, The Center for Strategic and International Studies, CSIS1999.

Inglehart R, Modernization and Postmodernization: Cultural, Economic and Political Change in 43 Societies. Princeton, N.J.: Princeton: Princeton University Press, 1997.

Inglehart R & Welzel C, Exploring the Unknown: Predicting the Responses of Publics not yet Surveyed. International Review of Sociology / Revue Internationale de Sociologie, Vol. 15, No. 1, March 2005. http://www.worldvaluessurvey.com.

Kaplan, R & Norton D, The Balanced Scorecard, Boston, Harvard Business School Press, 1996. http://www.sveiby.com/articles/IntangibleMethods.htm

Keenan, M, Miles I, Fahri F and Lecoq D, Creating Vision in the Regions: a framework for organising Regional Foresight. IPTS Report no 59 Nov 2001.

Kenworthy L and Kittel B, Indicators of Social Dialogue: Concepts and Measurements, Policy Integration Department, Statistical Development and Analysis Group, International Labour Office, Geneva, 2003.

Linstone, H A and M. Turoff, Eds. The Delphi method: techniques and applications. London, Addison-Wesley Publishing Company 1975.

Local Government Association Futures Toolkit. The future: why consider it?
http://www.lga.gov.uk/lga/toolkit/index.htm
http://www.lga.gov.uk/lga/toolkit/futures%20methods.pdf

Makridakis S, Wheelwright S, et al. Forecasting: methods and applications. New York, John Wiley & Sons 1983.

Martino J P, Technological forecasting for decision making, 3rd ed. New York, McGraw-Hill 1993.

Masini B E, Why futures studies? London, Grey Seal Books 1993.

Mercer D, A General Hypothesis of Aggregated Expectations, pp 145-154, Technological Forecasting and Social Change, Vol. 55, 1997.

Michael J & Mazarr, Global trends research paper. The five paradoxes. Business competition in the knowledge era. Center for Strategic and International Studies 2005. http://www.csis.org/europe.

Miles I, Technology Foresight: Implications for Social Science, CRIC, University of Manchester, Working Paper no 3, 1997. ISBN 1 84052 002 7. http://les1.man.ac.uk/cric/.

Miles I, Services and Foresight. Service Industries Journal vol. 19 no 2. April 1999.

Mitleton-Kelly E, Complex Systems and Evolutionary Perspectives on Organisations. The Application of Complexity Theory to Organisations. Pergamon. Amsterdam 2003.

Moore J, The Death of Competition. New York: HarperBusiness, 1996.

Naumanen M, Teknologiabarometri kansalaisten asenteista ja kansakunnan suuntautumisesta tietoon perustuvaan yhteiskuntaan. Tekbaro 2004.

Niblett R and Mix D, Euro Focus: Europe in 2005: A distracted partner. http://www.csis.org/europe

Nonaka I & Takeuchi H, The knowledge creating company, New York; Oxford, Oxford University Press, 1995.

Popper S W & Wagner C S et al, New Forces at Work: Industry Views Critical Technologies, RAND, Santa Monica, CA 1998.

Schartz P, The art of the long view: planning for the future in an uncertain world. Wiley, Chichester etc. 1998, ISBN 0-471-97785-3.

Porter, The Competitive Advantage of Nations, Free Press, New York 1990.

Romer P M, Increasing Returns and Long-Run Growth, Journal of Political Economy (94) 1986, 1002-1038.

Rosselet-McCauley S, Methodology and principles of analysis. Competitiveness Project, IMD, 2005.

Rouvinen P, Muistio IMD:n World Competitiveness Yearbook 2005 -julkaisusta. Etlatieto Oy, 9.5.2005.

Stelios H & Zanakis & Becerra-Fernandez I, Competitiveness of nations: A knowledge discovery examination. European Journal of Operational Research 166, 2005.

Stewart T A, Intellectual Capital, The new wealth of organizations. New York, Doubleday, 1997.

Streeck W, Social Institutions and Economic Performance, Studies of Industrial Relations in Advanced Capitalist Economies. London, Sage 1992.

Ståhle P & Grönroos M, Dynamic Intellectual Capital. The Theory and Practice of Knowledge Management. WSOY, 2000.

Ståhle P, Ståhle S & Pöyhönen A, Analyzing Dynamic Intellectual Capital. A System-based Theory and Application. Lappeenranta University of Technology, 2003.

Sveiby K E, The New Organizational Wealth; Managing and Measuring Knowledge-based Assets, San Fransisco, Berret-Koehler Publ, 1997.

Sybille R & Tauch C, Trends III - Learning Structures in European Higher Education, A report prepared for the European University Association. First draft EUA Graz Convention. 29/31 May 2003.

Tálos E & Kittel B, Gesetzgebung in Österreich. Netzwerke, Akteure und Interaktionen in politischen Entscheidungsprozessen. Wiener Universitätsverlag 2001.

Waldrop M, Complexity: The Emerging Science at the Edge of Order and Chaos. New York: Simon and Schuster, 1992.

Welzel C & Inglehart R, Human Development and the "Explosion "of Democracy: Variations of Regime Change across 60 Societies. ISSN 1615-7559.

Annual Innovation Policy Report for Finland. Covering the period September 2003 – August 2004. The present report was prepared by Juha Oksanen, Pirjo Kutinlahti and Marjo Uotila of VTT Technology Studies. The information contained in this report has not been validated in detail by either the Member States or the European Commission. European Commission. Enterprise Directorate-General.

Innovation policy in Europe 2002. European Trend Chart on Innovation Luxembourg: Office for Official Publications of the European Communities, 2002 ISBN 92-894-4494-0.

OECD, The Knowledge-Based Economy, 1996.

Report by the committee for the future on the government's report Finland 2015: balanced development. TuVM 1/2002 vp – VNS 4/2001 vp. http://www.parliament.fi.

Websites and online publications

International

http://www.cordis.lu/innovation-smes/src/innobarometer.htm

Innobarometer, EU, European Commission 2003.

http://www.undp.org/hdr2003/

UNDP (2003) Human Development Report 2003. Millennium Development Goals: A compact among nations to end human poverty. United Nations Development Programme (UNDP). New York, Oxford. Oxford University Press.

http://europa.eu.int/comm/enterprise/entrepreneurship/support_measures

Final report of the expert group on enterprise clusters and networks, European Union, 2003.

http://trendchart.cordis.lu/Reports/Documents/report5.pdf.

"Lifelong learning boosts innovation," in: Innovation and Technology Transfer, Special Edition: European Trend Chart on Innovation. Reviewing Europe's progress in 2002, European Commission (DG Research, Innovation Directorate), February 2003.

http://www.eurofound.eu.int

Sector Futures: The future of IT

Sector Futures: Shaping the future of ICT

Sector Futures: Policies, issues and the future of ICT

European Foundation for the Improvement of Living and Working Conditions

http://futures.jrc.es

http://foren.jrc.es

http://www.jrc.es

The FOREN Future website / European Commission Directorate-General JRC, Joint Research Centre.

The IPTS Futures Project. Synthesis Report.

K. Matthias Weber, Mario Zappacosta & Fabiana Scapolo (IPTS), The Futures Project: The Competitiveness Map, Avenues for Growth.

James P Gavigan (IPTS), Mathias Ottitsch (IPTS) and Celia Greaves (CEST, UK) Demographic and Social Trends Panel Report.

Dr. David Mercer, Demographic and Social Trends Issue Paper: The Future of Education in Europe until 2010.

http://www.oecd.org/statistics/statlink

http://www.oecd.org/els/education/adultlearning

OECD (2003) Beyond rhetoric: Adult learning policies and practices, (Paris: OECD).

http://www.foresight.gov.uk

Foresight programmes themselves; in particular the UK national programme has extensive documentation on other programmes and helpful search facilities.

http://www.wbcsd.org/

WBCSD 1997. WBCSD Global Scenarios 2000-2050: exploring sustainable development.

http://www.sfutures.com/web-lnk1.htm#Consult

Finding who is doing what, and where, in forecasting, futures research, strategic management.

http://ag.arizona.edu/futures/fut/futmain.html

Futures related sites, reference data and methods.

http://www.coatesandjarratt.com/resources.htm

Futures organizations and research centres, Futures consultants, Scenarios pages, publications and forums.

http://www.wired.com/wired/scenarios/build.html

One view as to how to build scenarios.

http://www.gbn.org/

A view on using scenario planning.

http://www.geocities.com/~acunu/

Making use of Futures thinking; the UN University "Millennium Project".

http://gwforecast.gwu.edu/index.asp

George Washington University "Emerging Technologies" study.

http://morris.wharton.upenn.edu/forecast/

Summary of useful knowledge about forecasting that can be used by researchers, practitioners, and educators.

http://50k.mit.edu/
http://50k.mit.edu/global/

Structural Components and Operations of the MIT $50K Entrepreneurship Competition.

http://www.itps.se

Social capital, innovation policy and the emergence of the knowledge society: A comparison of Sweden, Japan and the USA. ITPS, Swedish Institute For Growth Policy Studies. ISSN 1652-0483.

Örjan Sölvell, Kluster och den nya näringspolitiken. ISSN 1652-0483.

A learning ICT policy for growth and welfare ITPS 'final report on its assignment of evaluating the Swedish ICT policy. ISSN 1652-0483. Stockholm 2003.

Anne Kolmodin and Aurora Pelli. Design for Innovation and Growth – a promising competitive concept in the future? ISSN 1652-0483.

http://www.iftf.org/

2003, Ten-Year Forecast. Silicon Valley, the Institute for the Future (IFTF).

http://www.elsevier.com/locate/dsw

Stelios H.Zanak and Irma Becerra-Fernandez, Competitiveness of nations: A knowledge discovery examination. European Journal of Operational Research 166 (2005).

http://www.dti.gov.uk/

Foresight Futures 2020: scenarios and user guidance. SPRU-Science and Technology Policy Research, University of Sussex, 1998.

Finnish

http://global.finland

Finland ś Report on the Millennium Development Goals

http://www.tekes.fi/english/publications

NETS – Networks of the Future 2001 –2005. ISSN 1239-1336. ISBN 952-457-172-2. Printers: Libris Oy, Helsinki 2005.

http://www.sitra.fi

Suomi innovaatiotoiminnan kärkimaaksi. Kilpailukykyinen innovaatioympäristö - kehittämisohjelman loppuraportti. ISBN 951-563-499-7. ISBN 951-563-500-4. Edita Prima Oy, Helsinki 2005.

Peter Ekholm ja Sitra, EU vuonna 2020. ISBN 951-37-4281-4. Edita Prima Oy, Helsinki 2004.

http://www.ymparisto.fi/julkaisut

Alueellisen ekotehokkuuden mittaaminen mallina Kymenlaakso. ISBN 952-11-1884-9. ISBN 952-11-1885-7 (PDF). Edita Prima Oy, Helsinki 2004. Julkaisu on saatavana myös internetissä.

Ulla Rosenström ja Per Mickwitz, Kymenlaakson ekotehokkuuden mittaamista tukevat sosiaaliskulttuuriset indikaattorit. ISBN 952-11-1698-6. ISBN 952-11-1699-4 (PDF). Paino: Dark Oy, Vantaa 2004. Julkaisu on saatavana myös Internetistä

Ilmo Mäenpää ja Esa Mänty, Kymenlaakson taloudelliset ja ainevirtaindikaattorit. ISBN 952-11-1694-3. ISBN 952-11-1695-1 (PDF). Paino: Dark Oy, Vantaa 2004. Julkaisu on saatavana myös Internetistä.

http://www.tekes.fi/eu/fin/julkaisut/index.html

Marjo Uotila, Pirjo Kutinlahti, Soile Kuitunen and Torsti Loikkanen, Finnish Participation in the EU Fifth Framework Programme and Beyond. Publications of the Finnish Secretariat for EU R&D 1/2004. May 2004. ISSN 1238-7827. ISBN 952-457-169-2. The report is availabe in pdf format on the internet.

http://www.hel.fi

Tarja Meristö, Sami Leppimäki ja Mari Tammi, ICT-Osaaminen 2010. Tietoteollisuuden ja digitaalisen viestinnän osaamisen ennakointi.

Yrjö Myllylä, Osaamisen ja täystyöllisyyden Suomi. Työvoima 2020 loppuraportti, Palvelu- ja ihmissuhdetaitoinen Helsinki 2015.

http://www.hel.fi/ennakointi

Helsingin opetusviraston kehittämä ennakoinnin palvelu / mm. ennakoinnin tilastollisia lähtötietoja ja tutkimusraportteja.

http://www.ek.fi
http://www.tt.fi/julkaisut

Tulevaisuusluotain, Menestysklustereita tänään ja 2015: Faktaa ja visioita osaamisen ennakoinnin tueksi. Väliraportti. Elinkeinoelämän keskusliitto, EK.

http://www.tt.fi/tulevaisuusluotain

Osaamisintensiivinen Suomi 2012, - menestysklustereita, osaamista ja koulutusinnovaatioita. Väliraportti 2, 2002.

The TT Future Probe, A Competence-intensive Finland 2012. Final Report.

Marita Aho, Henni Timonen (toim.), Osaamistarpeita ja niiden taustaa suomessa vuonna 2012. Väliraportti 1. Teollisuuden ja Työnantajain Keskusliitto. Koulutuspolitiikka.

http://www.tse.fi/tutu

Nina Suvinen, The usefulness of foresight data for future planning. Futura 2/02.

The Foresight Database of the Centres for Employment and Economic Development (TE - keskusennakointi):
http://193.209.42.50/new/ennakointi/

The Foresight Database for Regional Occupational Education Demand, AKE (Alueellisen ammatillisen koulutuksen tarpeen ennakointi): http://194.89.205.3/suom/laanit/eslh/yksikot/sivistys/projekti/index.htm

Michael Kuhndt and Justus von Geibler, "Developing a Sectoral Sustainability Indicator System using the COMPASS methodology ". Futura 2/02.

Kaivo-oja, Jari, Luukkanen, Jyrki and Malaska, Pentti, Methodology for the Analysis of Critical Industrial Ecology Trends: An Advanced Sustainability Analysis of the Finnish Economy. Futura 2/02.

Jari Välimäki, The information society and the use of sustainable development indicators. Futura 2/02.

Kestävän tiietoyhteiskunnan indikaattorit, Indicators of sustainable Information Society. Tutu-julkaisut. ISBN 951-564-111-X.

Sirkka Heinonen, Olli Hietanen, Ene Härkönen, Kati Kiiskilä & Laura Koskinen, Kestävän kehityksen tietoyhteiskunnan SWOT –analyysi. Tutu-julkaisut. ISBN 951-564-094-6.

Olli Hietanen & Katriina Siivonen, Tietoyhteiskunta,, kestävä kehitys ja kulttuuri. Tutu-julkaisut. ISBN 951-564-093-8.

http://www.tietoyhteiskuntaohjelma.fi

Tulevaisuuden verkottuva Suomi. Tietoyhteiskuntaneuvoston raportti 2005.

Statistical sources

International

http://unstats.un.org/unsd/demographic/products/socind/

UNSTATS: United Nations Statistics Division –demographics.

http://unstats.un.org/unsd/mi/mi_links.asp

UNSTATS: UN Millenium development goals.

Creating an Enabling Environment: Toward the Millennium Development Goals. United Nations ICT Task Force Secretariat. UN ICT TF, http://www.unicttaskforce.org.

http://www.oecd.org/statistics/

Statistics on member countries. OECD in Figures, 2004 edition.

OECD (2004), Main Economic Indicators.

http://www.oecd.org/document/7/0,2340,en_2649_34213_20600455_1_1_1_1,00.html

OECD: Futures oriented sites by nation or region.

http://www.oecd.org/document/24/0,2340,en_2825_497118_2671576_1_1_1_1,00.html

OECD: Organisation for Economic Co-operation and Development. Society at a glance, Social indiacators.

Kurt Larsen, John P. Martin, and Rosemary Morris, Trade in Educational Services: Trends and Emerging Issues. Achieving the MDGs and related outcomes: A framework for monitoring polcies and actions. Development committee. (Joint Ministerial Committee of the Boards of Governors of the Bank and the Fund On the Transfer of Real Resources to Developing Countries), IMF and WB. OECD, 2002.

OECD (2000a), International Trade in Educational and Professional Services: Implications for Higher Education.
OECD (2000b), Education at a Glance, Paris.
OECD (2001a), Student Mobility Between and Towards OECD Countries - A Comparative Analysis, (Paris).
OECD employment outlook – ISBN 92-64-10812-2 – © OECD 2004.

Marco Manacorda and Alan Manning, Shifts in the Demand and Supply of Skills in the OECD. OECD 2001.

http://www.oecd.org/socialmin2005

Key statistics: extending opportunities: How active social policy can benefit us all. OECD: OECD Guidelines for Multinational Enterprises (revised June 2000).

http://eu.int.org

Anna Michalski and Lucio R. Pench, Scenarios Europe 2010. Five possible futures for Europe. Gilles Bertrand (Coord.). European Commission, Forward Studies Unit, 1999.

Competitiveness and benchmarking. European competitiveness report 2004. Commission staff working document SEC(2004)1397. Office for Official Publications of the European Communities, 2004. ISBN 92-894-8227-3.

http://epp.eurostat.cec.eu.int/

EUROSTAT statistics on e.g. the following areas:

General
Structural Indicators
Euro-Indicators
Yearbook 2004
Sustainable Development
Themes
General and regional statistics
Economy and finance
Population and social conditions
Industry, trade and services
Agriculture and fisheries
External trade
Transport
Environment and energy
Science and technology

http://www02.imd.ch/wcc/criteria/

IMD: Institute for Management and Development.

IMD World competitiveness yearbook 2004, 2005.
The world competitiveness scoreboard 2004, 2005.

http://www.imf.org/external/pubs/ft/weo/2004/02/index.htm

IMF: International Monetary Fund.

http://www.imf.org

World Economic Outlook, Statistical appendix, Economic prospects and policy issues, International Monetary Fund, IMF 2004, 2005.

http://www.weforum.org/

WEF: World Economic Forum.

http://www.eib.org

EIB: European Investment Bank.

http://www.acunu.org/

ACUNU: American Council for the United Nations University
2004 STATE OF THE FUTURE, UN/ACUNU.
http://www.stateofthefuture.org

Jan Vandemoortele, Are the MDGs feasible? United Nations Development Programme Bureau for Development Policy New York 2002.

http://www.wto.org/english/res_e/statis_e/statis_e.htm
WTO: World Trade Organization.
e.g. Annual Report 2004.

http://www.ilo.org/trends
http://www.ilo.org/public/english/employment/strat/wrest.htm
http://www.ilo.org/public/english/index.htm
ILO: International Labour Organisation.

Global Employment Trends Brief, February 2005.

Work in the global economy. Papers and proceedings of an international symposium. 2003. ISBN (Print) 92-9014-739-3. ISBN (Web PDF) 92-9014-740-7.

http://www.itaa.org
The Employment Outlook in Today ś Increasingly Competitive IT Job Market
Information Technology Association of America
Annual Workforce Development Survey 2004

http://www.wider.unu.edu
Wiid1 ja Wiid2 Database
http://www.wider.unu.edu/wiid/wiid.htm

Dani Rodrik, Rethinking Growth Strategies. UNU World Institute for Development Economics Research (UNU-WIDER). ISSN 1455-3082.ISBN 92-9190-679-4.

Bart Capéau1 and André Decoster, The Rise or Fall of World Inequality A Spurious Controversy? UNU World Institute for Development Economics Research (UNU-WIDER)
ISSN 1609-5774. ISBN 92-9190-570-4.

http://www.jrc.com
Ken Ducatel and Jean Claude Burgelman, The Futures Project, Employment Map. European Commission, Directorate-General JRC, Joint Research Centre.

http://www.statistics.gov.uk.
Carol Summerfield, Penny Babb, Social Trends. No. 34, 2004 edition. A National Statistics publication, © Crown copyright 2004. Published with the permission of the Controller of Her Majesty ś Stationery Office (HMSO).

http://www.bris.ac.uk/Depts/Economics/Growth/datasets.htm

BRIS: Links to international growth figures, including the following datasets and sources:

* Penn World Table (Summers-Heston data set)
* Barro-Lee (1993) growth data set
* Barro-Lee (2000) education data set
* Political instability and growth data set
* Sachs and Warner data sets
* Social Indicators of Development
* Trends in Developing Economies
* World Bank Growth Research
* World Bank World Tables

http://www.guidance-research.org/future-trends/

NGRF: National guidance research forum.

Finnish

http://tilastokeskus.fi/tup/tilvir/julkaisijat_kansainvaliset.html

STATFI: Links to international statistics providers.

http://www.stat.fi/

STATFI: Finnish and international statistics.

http://www.bof.fi/fin/5_tilastot/index.stm

Outlook for the Finnish Economy 2005 –2007. Forecast tables 30 March 2005. Appendix to Euro & talous journal 1/2005. Bank of Finland. Monetary Policy and Research Department.

Euro & talous 1 •2005. Bank of Finland publication series.

http://www.vm.fi

Economic Survey 1a /2005. Ministry of Finance, Economics Department. ISSN 1455-7606. ISBN 951-804-492-9.

http://www.vnk.fi

Finland's competence, openness and renewability. The final report of the "Finland in the Global Economy" project. ISBN 952-5354-68-7. ISSN 0783-1609.

Gianmarco I.P. Ottaviano and Dino Pinelli, The challenge of globalization for Finland and its regions: The new economic geography perspective. ISBN 952-5354-66-0. ISSN 0783-1609.

http://www.parliment.fi

Pekka Himanen Challenges of the global information society. 2004. ISBN 951-53-2643-5 (nid.). ISBN 951-53-2644-3 (PDF).

http://www.etla.fi/suhdanne/

ETLA: Research Institute of the Finnish Economy.

http://www.vatt.fi/

VATT: Government Institute for Economic Research.

Seija Ilmakunnas, Jaakko Kiander, Pekka Parkkinen and Antti Romppanen, Globalisation: The end of work? the economy and employment in Tinland to 2030. Valtion taloudellinen tutkimuskeskus. Government Institute for Economic Research. Helsinki 2000.

http://www.ptt.fi/

PTT: Pellervo Economic Research Institute PTT.

http://www.eva.fi/

EVA: Finnish Business and Policy Forum EVA.

http://www.tulli.fi/fi/05_Ulkomaankauppatilastot/09_Tilastopalvelu/index.jsp

TULLI: Statistical services of Finish Customs

http://www.stakes.info/3/index.asp

STAKES: National Research and Development Centre for Welfare and Health /statistics.

http://www.mol.fi/mol/fi/06_tyoministerio/07_tilastot/index.jsp

MOL: Ministry of Labour statistical services.

www.mol.fi/webammatti

Occupations and occupational fields. Ministry of Labour

http://www.oph.fi/
http://www.edu.fi/
http://www.minedu.fi/

OPM: Ministry of Education statistical services

http://www.tekes.fi

Finnish Funding Agency for Technology and Innovation TEKES.

http://www.tieke.fi/tilastot/

ICT Cluster Finland Review 2005. TIEKE Finnish Information Society Development Centre.

http://www.teknologiateollisuus.fi/tilastot

Federation of Finnish Technology Industries

http://www.bioteknologia.info

Biotechnology info – Internet service

http://www.oph.fi/info/ensti

Internet-based foresight knowledge service ENSTI.

http://www.chemind.fi

Chemical Industry Federation of Finland

http://www.metsafoorumi.fi

Future Forum on Forests

http://www.forestindustries.fi

Finnish Forest Industries Federation

http://www.rakennusteollisuusrt.fi

Confederation of Finnish Construction Industries

RECENT FFRC eBOOKS

6/2007 Grönqvist, Laura: Brändisijoittelun vastuullisuus. Suomalaisten televisioalan johtajien näkökulmia televisiotuotannon kaupallistumiseen.

5/2007 Hakola, Paula, Horn, Susanna, Huikuri, Sanna, Kinnunen, Miia, Näyhä, Annukka, Pihlajamäki, Mia & Vehmas, Jarmo: Ilmastoliiketoiminta ja energia Suomessa 2050. Skenaariot ja strategiat (ILMES).

4/2007 Kuusi, Osmo & Hiltunen, Elina: The Signification Process Of The Future Sign.

3/2007 Aalto, Hanna-Kaisa; Ahokas, Ira & Kuosa, Tuomo: Yleisivistys ja osaaminen t yöelämässä 2030. Menestyksen eväät –hankkeen väliraportti.

2/2007 Hiltunen, Elina: Where Do Future-Oriented People Find Weak Signals?

1/2007 Tapio, Petri, Kohl, Johanna, Tikkanen, Sarianne & Salonen, Sofi: Kestävän kehityksen torille 2020. Skenaarioraportti.

2/2006 Niemi, Erika, Kaskinen, Juha, Honkatukia, Juha, Törmä, Hannu & Hoffmann, Torsten: Valtatie 8:n Turku –Pori-yhteysvälin kehittämisen yhteiskunnalliset ja alueelliset vaikutukset. Loppuraportti.

1/2006 Hakola, Paula & Kinnunen, Miia: Ilmastoliiketoiminta ja energia Suomessa 2050 (ILMES) –Skenaariot ja strategiat.

FFRC eBOOK 7/2007

Pirjo Ståhle & Sten Ståhle

EDUCATION INTELLIGENCE SYSTEM (EIS)

ISBN 978-951-564-512-8

ISSN 1797-132