



Development of Indicators for “Transformative Use of ICTs in EU Regions” – Indicator Suggestions and the Way Forward –

Prepared as Input for the 2nd TRANSFORM Indicator Workshop, Bilbao, 14 June 2007

Introduction

TRANSFORM (“Benchmarking and Fostering Transformative Use of ICT in EU Regions”; IST-022780) is a so-called Specific Support Action in the 6th Framework Programme of European Commission supported R&D. It started on the 1st of January, 2006 and will be running for a period of 30 months. As part of the project, two **groups of external experts** have been set up to give advice to the consortium.

TRANSFORM applies analytical tools to understand the difference in regions’ performance in the knowledge-based economy and society, and to develop insight into how regional policy-making can help foster positive change. The project focuses on “transformative” uses of ICT in European regions, and on exploring how they impact on regions’ performance in the knowledge-based economy and society. Specific attention is given to the role of “soft factors” such as **social and networking capital, regional institutional capacity and regional “innovation cultures”**, and how these are related to the wide variety of observed outcomes among EU regions.

The research is divided in two strands. The **first strand** focuses on the role of ‘regional innovation cultures’ in explaining varying outcomes, based on in-depth interpretative case studies of 12 differing regions from across Europe. This part of the research is currently ongoing. Initial results will be discussed at an expert workshop to be held in autumn 2007.

The **second strand**, with which the present document is concerned, develops and refines methods for benchmarking regions according to uses of ICT which appear to be of most relevance for regional development. Indicators are to be defined at the level of individuals, firms and the public sector.

The project’s outcome will be theory-led, evidence based insight for policy-making, packaged in a number of dissemination products tailored to the specific needs of the various target audiences. TRANSFORM will provide important input to policy development at EU level, such as the monitoring of the new generation of Structural Funds programmes (2007-2013) and the

implementation of the i2010 strategic framework, in particular its Third Pillar which seeks to promote an inclusive European Information Society, by tackling – amongst other things – the regional digital divide. The aim is also to produce recommendations to the European Statistical System about how the current set of ICT related indicators should be supplemented in order to better reflect the regional impact dimension of ICT use.

The first step in indicator development was to take stock of existing statistical measures¹. The corresponding deliverable² discussed the most important gaps in availability of indicators and indicator data. The analysis showed that not only are many valuable indicators only available at the national level (i.e. not at regional level), but that also there are issues which appear to be of high relevance for the effective use of ICTs for regional development which are not at all being measured – at least not in a way which would allow cross-country comparisons.

Do We Need ICT Indicators?

From the viewpoint of regional development, what is of interest is not ICT as an end in itself but rather the outcomes of (transformative) use of ICTs. What is of concern here is the coupling of behaviours with their outcomes. Of course, in the longer term, these outcomes can be seen as the goals of the Lisbon agenda (growth and competitiveness, social cohesion, sustainability, jobs and human capital formation, good governance). Good, or at least reasonable, indicators exist for all of these domains. So why bother with indicators on ICT (which often have operational character rather than focusing on outcomes)? And why, in particular, should we bother with indicators about how ICTs are being used?

The problem is that structural outcome indicators are usually of little assistance to policy makers as they are too ‘causally distant’ from ICT-enabled

¹ “Existing” is understood as having been piloted and/or applied at a larger scale already. It does **not** mean that these indicators have all been collected at the European regional level already.

² TRANSFORM D2.1 “Indicator Stocktaking Report”, see www.transform-eu.org/publications/publications.html

transformative change to assist in making investment or regulatory decisions. As a result they 'arrive too late' to assist decision makers and it is difficult to causally disentangle the exact contributions of ICT-based transformative change. Policy-makers need more causally 'proximate' indicators of ICT-based transformative change if they are to be able to identify promising opportunities for investment. That is, they need 'leading indicators'. These indicators need to take account of the fact that there are huge differences in the **effectiveness** with which ICT is being applied across countries³ and also across regions⁴.

Transformation as a particular kind of ICT-enabled change has recently come to the fore in the public debate. "Transformative" is understood here as uses of ICT that open up substantially new ways for individuals, firms and governments to achieve their goals. In many cases, this refers to activities which **would not have been possible** without ICTs.

The key issues that emerged from our research so far as promising candidates for leading indicators can be grouped under three headings:

- The degree to which individuals, firms and the public sector are engaged in **network creation**, i.e. building and maintaining and network capital enabled or enhanced by ICTs;
- The extent to which regional actors are engaged in ICT-based or ICT-enhanced **continuous** and **collective learning**, and the translation of these into innovation;
- The level of ICT-enabled or ICT-enhanced **participation** in decision- and policy-making in the regional society, including issues of **empowerment** of citizens, workers, and SMEs.

Do We Need *Regional* ICT Indicators?

The focus in TRANSFORM is on transformational change which is of benefit for **regional development** at large. For the definition of the overarching goals of regional development, our point of reference are the revised Lisbon agenda and, as far as applications of ICT are concerned, the i2010 strategic framework.

At the regional level, policy-makers need indicators which represent the geographical reference unit at which they (as opposed to national actors) operate. Only then can indicators

fulfil the function of giving input to the policy-making process in EU regions.

At the EU level, the European Commission's emphasis on inclusive Information Society policies has directed attention to **regional digital divides** as sources of continuing or even exacerbated disadvantages affecting of peripheral or otherwise weak EU regions⁵.

Moreover, it has been remarked repeatedly that the European Commission spends a considerable (and increasing) share of its Structural Funds budgets on regional development initiatives in which ICT plays a major role⁶. But this is being done against a backdrop of a lack of regional data on ICT use and ICT-derived effects, raising doubts whether the tools are in place to evaluate (and subsequently improve) the effectiveness of regional aid of this type.

We believe that indicators on transformative use of ICTs in EU regions can play an important role for identifying regional policy challenges, assessing the current situation, and evaluating whether policy objectives are being met.

National and regional indicators can have a number of different relationships:

- Some indicators can be applied in the same way at the national and the regional or local level. This is the case for most indicators for which the unit of observation is the individual household or firm. For example, the share of individuals or firms using ICTs (such as the Internet or mobile devices) are measures the value of which for analysis does not differ between geographical reference units.
- Some indicators are applicable mainly at the national level and much less at the regional or local level. This applies to constructs for which the country is the main unit of analysis, for example because of the system of governance in place⁷. An example would be a measure on the existence of regulatory frameworks which are set at the national level, with regional or local governments having little or no say.

³ For an overview, see OECD (2004) 'The Economic Impact of ICT – Measurement, Evidence and Implications', Paris: OECD. For recent evidence, see Bloom, N. et al. (2007) 'Americans Do I.T. Better: US Multinationals and the Productivity Miracle', Discussion Paper 788, London: Centre for Economic Performance.

⁴ See Editorial Team established by the Coming Presidencies Group (2006): "The Territorial State and Perspectives of the European Union", Background document for the Territorial Agenda for the EU.

⁵ See Riga Ministerial Declaration on eInclusion, URL: http://ec.europa.eu/information_society/policy/accessibility/eincl/policy/2006-riga/index_en.htm. See also CEC (2006) 'Proposal for a Council Decision on Community Strategic Guidelines on Cohesion', COM(2006) 386 final.

⁶ In the period 2000-2006 €7 billion were devoted under the Structural Funds on ICT-related projects, see CEC (2007) 'i2010 – Annual Information Society Report 2007, Brussels: CEC, p. 6.

The new "Regions for Economic Change" initiative will over the period 2007-2013 focus € 375 million of Structural Funds money on testing best practice for economic modernisation and increased competitiveness of EU regions. Among its key themes is "encouragement of innovation, entrepreneurship and the growth of the knowledge economy".

⁷ This means that the degree to which indicators are of interest for regional benchmarking depends partly on the specific structures of government and public administration in a country.

- Some indicators are more valuable if collected at regional level, as aggregation at national level would be likely to hide significant differences between sub-national units. An example would be prices for advanced telecommunications services, which often differ considerably within Member States between the dominant agglomerations and the periphery.
- Another type of indicators are those which should be collected at regional or local level, but which are mainly of relevance for policy-making at national level. This concerns indicators describing the geographical effects of policies which are set at the national level (depending on the country, this typically includes spending on defense, higher education, publicly funded R&D, etc.). It may also include indirect effects of nation-level policy-making, such as the spatial impact of industry policy.
- By contrast, indicators which are of particular importance for policy-making at the regional level are those measuring phenomena which can be directly influenced by regional policy-makers. This includes investments in ICT infrastructure and applications, e-government related developments at the regional level, and supply & demand for ICT applications which are directly related to the region.

The decision at which geographical level indicators should be collected can thus only be taken after close analysis of the phenomenon to be measured.

i2010 Benchmarking Indicators

As starting point for the discussion, a number of existing indicator frameworks are of special relevance. This refers, in particular, to the **i2010 benchmarking indicators**, the European Commission's latest set of benchmarking indicators (not all of which available already) for measuring progress with respect to achieving its Information Society related policy goals⁸. Different data sources, including Eurostat's Community ICT Usage Surveys conducted annually and directed at households and enterprises, as well as one-off Eurobarometer surveys, are being utilised for the purpose.

The i2010 benchmarking indicators act as a point of reference, leading to a number of questions including: Can we identify those i2010 indicators which are of particular importance for transformative change? Are there country-level indicators which need to be modified in order to take account of the specific properties of regions as units of analysis, and of the specific

requirements of regional policy-makers? And are there issues of strong relevance for regional policy-making (against the background of the conceptual framework of TRANSFORM which highlights the role of "soft" issues as influencing transformational uses of ICT) which are not at all covered by the i2010 indicators?

i2010 indicators are grouped into nine themes:

- **Theme 1: Development of broadband** (population reached; number of subscribers by platform; percentage of households with access (by access devices); Percentage of enterprises with access; Prices.

The importance of broadband for regional development is uncontested. Both availability and prices, the latter often influenced by the existence of competition between different providers, need to be measured. These indicators present relevant background information for any strategy for the knowledge economy and society at regional level.

- **Theme 2: Advanced services** (Percentage of individuals using the Internet by age, gender, employment, status, education level, bandwidth; Percentage doing specific online activities: sending/receiving emails, using the Internet for advanced communications, finding information about goods and services, accessing/receiving online media subscriptions, using digital broadcasting services, playing/downloading games and music, using Internet banking, purchasing and buying online, and using the Internet for learning purposes; Indicators on advanced services to be developed).

The list of activities carried out using the Internet, as included in the current versions of the Community ICT Usage Surveys, appears to be too little guided by theory. For the purpose of implementing a cost-effective benchmarking framework at the regional level, it is required to shorten the module. In addition to applications of (typically stationary) Internet access, advanced mobile services should also be covered – not all of these make use of the Internet protocol or are recognised by users as doing so.

- **Theme 3: Security** (Indicators have not yet been developed.

This topic is considered of limited relevance for regional benchmarking.

- **Theme 4: Impact** (Share of ICT sector as proportion of GDP and total employment; growth of the ICT sector)

While the relative importance and growth of the ICT sector may be of key relevance for particular regions, the core focus for regional benchmarking should be on the extent to which the economy in general (across all sectors) exploits the potential

⁸ i2010 High Level Group (2006) 'i2010 Benchmarking Framework, Issue No. 1', Brussels: European Commission.

of ICTs. Too much emphasis on the ICT sector as a lead sector presumably driving economic development in regions has been identified as a common mistake in earlier attempts to foster the Information Society in European regions⁹.

- o **Theme 5: Investment in ICT research** (R&D expenditure by business sector, R&D expenditure in ICT by public sector)

Data on R&D expenditure by the business sector is being collected at the NUTS 2 level. R&D expenditure in ICT by the public sector would be of high interest for gauging the effort spent by regions to utilise ICT for improving their service. Doubts exist whether the data can be collected in a reliable manner.

- o **Theme 6: Adoption of ICT by businesses** (Percentage of persons employed using Internet in normal work routine; Percentage of enterprises with LAN, Intranet, Extranet; Enterprises with broadband access; Enterprises using open source operating systems; Enterprises turnover from e-commerce; Enterprises having received online orders; Enterprises having purchased online; Electronic integration of internal business processes; Integration with suppliers and/or customers; Use of CRM (customer relation management), Enterprises sending and/or receiving e-invoices; Enterprises that make secure online sales; Enterprises using advanced e-signatures.

Measuring applications of networked business, these indicators appear of high value for the purpose of benchmarking the extent to which a regions' company base is integrated into the network economy. From TRANSFORM's point of view, it would be essential to additionally collect information on the geographical spread of inter- and intra-firm linkages.

- o **Theme 7: Impact of adoption of ICT by business** (Share of persons employed with ICT user skills; share of persons employed with ICT specialist skills).

Since most ICT user skills are acquired by means of learning by doing, typically when using computers at work, it appears sufficient to collect data on "Percentage of persons employed using computers connected to the Internet, in normal work routine" (see Theme 6). Moreover, ICT skills should not be interpreted as a static set of capabilities but rather as the ability to continuously learn how to use new applications of ICT, since

most specific information is bound to become obsolete in a short time¹⁰.

ICT specialist skills are today employed across all sectors of the economy, which means that an indicator measuring the share of the labour force with such skills should be of relevance to all European regions. It should be taken into account, however, that disadvantaged regions would be unlikely to benefit from larger numbers of ICT specialists: they are more likely to suffer from low capacity of local employers to absorb expert knowledge rather than from lack of labour supply. This means that the number of ICT specialists should be interpreted as an indicator of absorptive capacity.

- o **Theme 8: Inclusion** (Reasons for not having Internet/broadband at home; Places at which Internet is accessed).

With regard to the reasons for not using the Internet or broadband access, existing evidence¹¹ would suggest that in-depth analysis of representative national datasets, using advanced statistical methods, is more likely to provide insight into existing barriers and patterns of behaviour than region-by-region data. The same applies to statistics on the place of Internet access. Because of the effect, by now well established, which price differences exert on broadband take-up, background information on prices and the degree of competition on the market for basic ICT services appears to be of more importance.

For addressing the issue of social inclusion in the Information Society, additional indicators are needed which measure the extent to which all sub-segments of the population exploit the potential of ICTs for empowerment. This relates to the application of ICTs to enable engagement in lifelong learning, social interaction, access to help in times of need, the generation and distribution of user-created content, and participation in policy-making (see below).

- o **Theme 9: Public services** (Number of "basic public services" fully available online; Share of individuals using Internet for interacting with public authorities by purpose: obtaining information, obtaining forms, returning filled in forms; Percentage of enterprises using the Internet for interacting with public authorities by purpose: obtaining information, obtaining forms, returning filled in forms, full electronic case handling, submission of proposal in an electronic tender system).

⁹ See Cornford, J. (2003) 'The Evolution of the Information Society and Regional Development in Europe', in Avgerou, C. and Lèbre La Rovere, R. (eds.) 'Information Systems and the Economics of Innovation', Cheltenham: Edward Elgar, pp. 15-32.

¹⁰ Castells, M. (2001) 'The Internet Galaxy – Reflections on the Internet, Business, and Society', Oxford and New York: Oxford University Press; p. 91.

¹¹ E.g. van Dijk, J.A.G.M. (2005) 'The Deepening Divide – Inequality in the Information Society', Thousand Oaks, London and Delhi: SAGE.

While the focus of benchmarking activities in the area of eGovernment applications has been on front-office public administrative services until now, most experts seem to agree that a shift in direction is asked for. Benchmarking of the online availability of public services should not be replicated at the regional level. Rather, the emphasis should be placed on the ultimate outcome of such eGovernment applications (i.e. effort needed for administrative tasks, and satisfaction with delivery) without viewing online delivery as an end in itself. In many cases, the telephone may prove to be the more user-friendly customer interface¹². By measuring overall effectiveness of customer service, efforts to reorganise back-offices for increasing efficiency and user-orientation would also be taken into account¹³.

In addition, eGovernment applications which improve the possibility for citizens to engage actively in the policy-making process (eParticipation) should be made subject of indicator development.

Currently, the i2010 benchmarking activities do not consider regional benchmarking. A possible approach towards achieving availability of regional-level indicators would be to simply press for a modification of sampling sizes, sampling frames and possibly also the legal basis for data collection by NSIs and other institutions, with a view to provide all (or a selection of) i2010 indicators also at the level of NUTS1 or even NUTS2 level. The problem here is that this would require a considerable increase of spending for data collection.

Other European Indicator Frameworks

The most important up-and-running mechanism for the purpose of data collection on Information Society related issues (including the i2010 indicators discussed above) are the annual **Community Surveys on ICT Usage**, established in 2002 by the European Commission in view of an increasing demand for official statistics on ICT related issues within the EU (Eurostat 2006a). Indicators derived from the data are used to benchmark ICT-driven developments in enterprises and by individuals.

Currently, none of the indicators derived from the harmonised Community Surveys on ICT Usage is available at the sub-national level, apart from a basic distinction made between Objective 1 and non-Objective 1 regions within each Member State. However, the latest guidelines for the

enterprise survey recommend to supply, on a voluntary basis and for small and medium enterprises only, regional data at NUTS 1 or NUTS2 level for the following variables:

- Use of computers;
- Had access to Internet during January 2005;
- Connected to the Internet via fixed broadband;
- Have a web site or a homepage;
- Have ordered via Internet in reference year;
- Person employed uses any computer.

For the household survey, the latest guidelines mention that regional data is to be supplied on a voluntary basis for the following variables:

- Any member of the household has access to the Internet at home;
- Household uses a broadband connection;
- Has never used a computer;
- In the last 3 months, has accessed the Internet, on average, at least once a week;
- Has ordered goods or services, over the Internet, for private use.

It remains to be seen how many Member States (if in fact any) will chose to collect regional data for these variables. Current sample sizes and sampling frames let us assume that most Member States will not be able to do so.

Another source of indicators which are of high relevance for measuring success in the knowledge-based economy & society is the **Community Innovation Survey** (CIS). The survey tracks the level of innovative activity of firms and the role of co-operation for innovation. The newest edition also goes in some detail concerning the effects and barriers to innovative activity, innovation inputs, and the sources of information utilised¹⁴.

Some of the indicator data from the edition of the CIS-2 (1997) were broken down to the NUTS2 level for the 2003 Regional Innovation Scoreboard¹⁵. The exercise was not repeated because of the limited suitability of the sample for sub-national analysis (concerning, in particular, sample sizes per country and region).

This means that the only innovation indicators available in Eurostat's REGIO database are those derived from the patent registers of the **European Patent Office**: Patent applications to the EPO by priority year (total and by IPC sections, classes and subclasses); High tech patent applications to

¹² See eUSER Consortium (2006) 'Report on Current Demand/Supply Match and Relevant Developments', project deliverable, www.euser.eu.org.

¹³ See Millard, J. et al. (2004) 'Reorganisation of Government Back-Offices for Better Electronic Public Services – European Good Practices', Final Report, Brussels: European Commission.

¹⁴ See <http://trendchart.cordis.lu/scoreboards/scoreboard2006>

¹⁵ Hollanders, H. (2003) 'Regional Innovation Performances', 2003 European Innovation Scoreboard, Technical Paper No. 3, Brussels: European Commission.

the EPO by priority year; ICT patent applications to the EPO by priority year; and Biotechnology patent applications to the EPO by priority year. The shortcomings of patent data for benchmarking innovative activity are well-known¹⁶.

In addition to existing country-level data collection frameworks, up-and-running Regional Information Society observatories are of special relevance for TRANSFORM – in particular if they make use of a harmonised approach towards data collection for allowing cross-country comparisons, as is the case for the regions in the UNDERSTAND consortium¹⁷.

Suggested TRANSFORM Benchmarking Indicators

In our previous work we identified three key domains for which indicators are to be developed: network creation; continuous learning and innovation; and, participation and empowerment as useful proximate/leading indicators of ICT-based transformative change.

For each of the three domains, indicators are to be developed for three observation units: Citizens and civil society, firms, and regional government (public sector).

The following list of individual indicators focuses on indicators which, according to the preceding analysis in TRANSFORM, are considered of highest relevance for benchmarking the extent to which regions make transformative use of ICTs.

When assessing and developing indicators, we try to avoid drawing a clear distinction between drivers and outcomes/impact. This is because as soon as we analyse regions using a systems approach, it becomes obvious that factors such as, for example, social capital endowment are both impacting on a region's capacity for transformative change, as well as (possibly) being itself affected by transformative use of ICTs. Any indicator framework which assumes a linear causal relationship between readiness for uptake, intensity of usage and social/economic impacts is therefore in danger of misrepresenting reality and, as such, of little value for regional decision makers who seek insight into possibilities for effective policy action.

Selected Background Indicators

Broadband access (firms)

- Share of organisations having broadband access to the Internet;

¹⁶ See Arundel, A. & Hollanders, H. (2006) 'Searching the Forest for the Trees: "Missing" Indicators of Innovation – 2006 Trend Chart Methodology Report'; Brussels: European Commission.

¹⁷ See UNDERSTAND Consortium (2006) 'Methodology Handbook', project report, Swansea: University of Wales. See also www.understand-eu.net.

- Share of staff having broadband access to the Internet at their workplace;
- Prices for broadband access basket.

Broadband access (households)

- Share of households having broadband access to the Internet;
- Prices for broadband access basket;
- Stationary broadband availability: Percentage of population reached by switches equipped for DSL and/or living in houses passed by an upgraded cable.

Mobile broadband access (firms)

- Share of organizations having mobile broadband access to the Internet;
- Share of staff having mobile broadband access to the Internet for work purposes;
- Prices for mobile services basket.

Mobile broadband access (individuals)

- Share of households having mobile broadband access to the Internet;
- Mobile broadband availability;
- Share of total population who live in areas which are covered by 3G networks or WiFi;
- Prices for mobile broadband access basket.

Public investment in ICT

- Total public investment in ICTs per head;
- Broken down in hardware, software, services, R&D.

Note: Most technology roadmaps and foresight scenarios seem to agree that ubiquitous computing, (partly) based on mobile broadband access, will soon open up manifold possibilities for transformative change in the business as well as in the private/civil sphere¹⁸. For this reason we suggest to include mobile broadband access in future benchmarking frameworks.

Indicators on ICT-enabled Networking and Social Capital Building

Inter-firm collaboration

- Share of firms involved in collaboration in innovation related activities
- Share of firms involved in collaboration in other activities (not related to innovation)

¹⁸ See OECD (2006) 'OECD Information Technology Outlook', Paris: OECD; Srivastava, L. et al. (2006) 'digital.life – ITU Internet Report 2006', Geneva: International Telecommunication Union.

ICT-based Inter-firm collaboration

- Share of firms involved in online collaboration in innovation related activities with partners from (a) inside the region (b) from other regions (c) from abroad.
- Share of firms involved in online collaboration in other activities (not related to innovation)

Supply chain integration – Integration with suppliers and/or customers

- Share of enterprises whose business processes are automatically linked to those of their suppliers and/or their customers.
- Supply-chain integration involving partners from (a) inside the region (b) from other regions (c) from abroad.

Membership in (work-related) virtual communities

- Share of persons in paid work who are active members in virtual communities which are (at least partly) related to their work.

Membership in (leisure related) virtual communities

- Share of individuals who are active members in virtual communities which are not directly related to their work.

Heterogeneity of ICT-based personal networks

- Index which measures the degree to which the ICT-based personal networks of individual members of the population comprise different types of people (geographical location, ethnicity, occupation, socio-economic status)

Networking intensity of public sector institutions

- Network-analysis derived indicator measuring the extent to which a region's public sector institutions (including universities) are participating in (a) intra-region (b) cross-region (c) international collaborative research and/or deployment activities

Note: These indicators are informed by the findings of recent empirical research into the importance of social capital and network creation for regional development¹⁹. They take account of the vital distinction being made between different types of social capital, namely **bonding, bridging**

¹⁹ See e.g. Cooke, P. & Morgan, K. (1998) *The Associational Economy – Firms, Regions, and Innovation*, Oxford and New York: Oxford University Press; Huysman, M. and Wulf, V. (eds) (2004) *Social Capital and Information Technology*, Cambridge, MA and London: MIT Press; Iyer, S., Kitson, M. and Toh, B. (2005) *Social Capital, Economic Growth and Regional Development*, *Regional Studies*. 39(8): 1015-1040; O'Brien, D.J., Phillips, J.L. and Patsiorkovsky, V.V. (2005) *Linking Indigenous Bonding and Bridging Social Capital*, *Regional Studies*. 39(8): 1041-1051.

and linking social capital, all of which need to be sufficiently developed to foster growth and innovation in the knowledge-based economy.

Collaboration is to be operationalised as follows: "Collaboration means active participation in joint R&D and other innovation projects with other organisations (with other enterprises or non-commercial institutions). It does not necessarily imply that both partners derive immediate commercial benefit from the venture. Pure contracting out of work, where there is no active working together towards the same goal, is not regarded as collaboration."

Virtual communities to be operationalised as follows: A virtual community is a group of people who communicate exclusively or mainly via the Internet on specific topics which are of interest to them.

Indicators on Lifelong and Collective Learning and Innovation

ICT-enabled lifelong learning

- Percentage of persons engaged in an online eLearning course who state that they would not have engaged in a training course if it had not been possible online.

Digital skills

- Self-reported confidence in: (a) using a search engine to find information on the Internet; (b) using e-mail to communicate with others; (c) downloading and installing software onto a computer; (d) identifying the cause for computer problems.

Updating of digital skills

- Perceived opportunities to learn about new applications and uses through: (a) formalised educational institution (school, college, university, etc.); (b) training courses and adult education centres, on own initiative; (c) training courses and adult education centres, on demand of employer; (d) through self-study using books, Internet, CD-Roms, mobile services, etc.; (e) through self-study (learning by doing); (f) informal assistance from colleagues, relatives in friends and some other ways.

Collaboration & communication skills

- Self-reported confidence in: (a) working with a team of people; (b) listening carefully to colleagues; (c) selling a product or service; (d) counselling or caring for customers or clients; (e) persuading or influencing others; (f) instructing, training or teaching people; (g) making speeches or presentations; (h) writing long reports.

Self-management skills

- Self-reported confidence in: (a) planning activities; (b) organising one's own time; (c) thinking ahead; (d) detecting, diagnosing, analysing and resolving problems; (e) noticing and checking for errors.

Workplaces enabling experiential learning

- Percentage of persons employed using Internet in normal work routine;
- Share of persons in paid work who have a workplace in a knowledge-intensive environment. To be operationalised as follows: "Not all learning takes place intentionally or via learning-by-doing. One can also learn new things by observing what people around oneself are doing and talking about. Would you say that at your workplace it is easy to learn from observing what people around you are doing and talking about?"

Attitudes towards entrepreneurship

- Share of the labour force who have positive attitudes towards entrepreneurship (compound indicator).

Collaboration's effects on capacity to change

- Share of enterprises using virtual collaboration (see above) which report a positive impact on the capacity to change in the reference period. Capacity to change to be operationalised as follows: The effect on your organisation's ability to adapt quickly (a) to fluctuations in demand; (b) to unexpected changes in the market environment (if applicable); (c) to lack of available skills on the labour market (if applicable); (d) to new market opportunities.

Individual effects of innovation-related collaboration on firm performance

- Perceived importance of a number of hypothetical effects of collaboration for innovation, relating to a period of three years prior to the survey. Items include the following: (a) Increased range of goods and services; (b) Entered new markets or increased market share; (c) Improved quality in goods or services; (d) Improved flexibility of production or service provision; (e) Increased capacity of production or service provision; (f) Reduced labour costs per unit output; (g) Reduced materials and energy per unit output; (h) Reduced environmental impacts or improved health and safety; (i) Met regulation requirements.

Barriers that have negatively affected firms' innovation-related collaboration

- Perceived barriers which have been negatively affecting innovation-related collaboration in the reference period (three years prior to the survey). Items include the following: (a) Lack of funds within your enterprise/group; (b) Lack of finance from external sources; (c) Innovation costs too high; (d) Lack of qualified personnel; (e) Lack of information on technology; (f) Lack of information on markets; (g) Difficulty in finding cooperation partners; (h) Markets dominated by established enterprises; (i) Uncertain demand for innovative products; (j) No need to innovate.

Note: Following Cooke and Morgan²⁰, we define learning as "a change in a person's or organisation's capability or understanding". It is obvious from this definition that the learning process ("learning to learn") can hardly be measured directly because of its complexity. This implies that proxy indicators are all we can hope for. Of particular importance in this regard are indicators that focus on the dynamic nature of learning as opposed to regional stocks of competences/skills²¹.

Indicators on e-Participation and ICT-enabled Empowerment

Work in team/ project structures

- Share of workers whose job involves doing work in a team;
- Degree of autonomy of work in teams;
- Share of workers a major part of whose work is organised in projects;
- Team composition (members from other regions / other countries?).

ICT use for team/project work

- Share of workers whose job involves doing work in a team/project, and who use online ICTs for coordinating work in the team

Pro-active work organisation index

- Percentage of employees who have a high value on a compound index, calculated from individual indicators on: (a) Decentralised organisational structures; (b) Flexible ways of working; (c) Flexible business practices; (d)

²⁰ Cooke, P. & Morgan, K. (1998)

²¹ Compare Tuomi, I. (2006) 'The Future of Learning in the Knowledge Society – Disruptive Changes for Europe by 2020', in: Punie, Y. et al. (eds) 'The Future of ICT and Learning in the Knowledge Society', Joint Research Centre, Luxembourg: Office for Official Publications of the European Communities.

Corporate cultures which focus on people; (e) Continuous investment in lifelong learning; (f) Innovative performance measurement & reward schemes.

ICT-enabled access to resources (individuals)

- Percentage of individuals who have experienced ICT-enabled improved access to vital resources. Vital resources to be operationalised in reference to the list of “major moments in life” used in the research by the Pew Internet and American Life Project²².

ICT applications which are perceived by citizens as empowering

- Percentage of individuals who perceive specific applications of ICT in their region as empowering. Items sorted according to the following seven spheres of ICT applications: (a) Communicate (social interaction); (b) Perceive information (one-to-many); (c) Find information; (d) Take care of personal business, transactions and requests for assistance; (e) Entertainment; (f) Generate and distribute own content; (g) Participate in policy-making and public life; (h) Employment-related activities.

Availability of tools for eParticipation

- Index calculated from the extent to which online engagement is enabled, differentiated by the five stages in the policy-making cycle²³: (a) Agenda-setting; (b) Analysis; (c) Formulation; (d) Implementation; (e) Monitoring.

Citizen use of tools for eParticipation

- Index calculated from the extent to which citizens utilise the Internet and other ICTs to interact with others in order to influence the regional policy-making process (includes communication with elected representative, with other policy-makers in the region, with NGOs active in the region, etc.).

Note: For a meaningful analysis of transformation in the form of individual empowerment, a recourse to theories of human and social development is required. This, of course, implies the danger of culturally bounded value judgements.

Nevertheless, there appears to be a common understanding of some of the basic goals of social development, as reflected in the declaration of the World Summit of the Information Society (signed by 175 countries) which observed a “... common desire and commitment to build a people-centred, inclusive and development-oriented Information Society, where everyone can create, access, utilize, and share information and knowledge, enabling individuals, communities and peoples to achieve their full potential in promoting their sustainable development and improving their quality of life”²⁴. This is the basis on which the indicators above have been selected.

Next Steps in TRANSFORM

The list of suggested indicators, as presented above, is intended as input to the discussion among experts and project stakeholders about the need for region-level indicators on transformative use of ICTs.

After revision, a selection of indicators will be prototyped and piloted in a random sample survey to be carried out at regional level in selected NUTS2 regions. The project is investigating currently whether this pilot survey could be conducted in co-operation with ongoing Information Society observatories in EU regions.

Findings from the pilot survey will inform the project’s recommendations concerning how to achieve progress in the statistical coverage of Information Society related issues at the European regional level. The survey results will also be used, as far as possible, to enrich the qualitative analysis of regional innovation cultures in Europe.

What clearly emerges from the analysis undertaken so far is that an EU-wide set of indicators on transformative use of ICTs should not be understood as implying that all regions should simply strive to rank as high as possible on all measures. Because of the differences in policy contexts in Europe, the utilisation and interpretation of indicators need to be embedded in a process of **regional benchlearning**. Depending on a region’s current policy goals and historic trajectory, a given indicator can have a number of different uses²⁵:

- ‘Dietetic’ indicators – those which help policy makers to ensure ‘healthy’ normal functioning, good practice, standard operating procedures, industry norms, etc., and to

²² Horrigan, J.B. and Rainie, L. (2006) *The Internet’s Growing Role in Life’s Major Moments*; findings report and questionnaire, Washington, DC: Pew Internet & American Life Project.

²³ Compare Macintosh, A. (2003) *Using Information and Communication Technologies to Enhance Citizen Engagement in the Policy Process*; in OECD (ed) *Promise and Problems of e-Democracy: Challenges of Online Citizen Engagement*, Paris: OECD, 19-142.

²⁴ World Summit on the Information Society (WSIS)(2003) *Geneva Declaration of Principles*; WSIS-03/GENEVA/DOC/0004, URL: www.itu.int/wsisis/docs/geneva/official/dop.html

²⁵ Compare Cornford, J. (1999) *Counting Computers, or why we are not well informed about the information society*; in Dorling, D. & Simpson, L. (eds) *Statistics and Society*; London: Edward Arnold, pp. 384-390.

identify deviations from such 'normal' functioning. In short those that help to answer the question: is the patient well or ill?

- **Diagnostic indicators** – those that help policy makers to explain any 'abnormal' behaviours or deviations from normal healthy functioning. In short those that help to answer the question: what is wrong with the patient?
- **Therapeutic indicators** – which help policy makers to intervene in order to 'rectify' a condition or situation. In short, indicators which help to answer the question: Is what we are doing working?
- **Prognostic indicators** – those that help to predict future outcomes. In short, indicators which help to answer the question: what will happen in the future given a certain set of conditions or interventions?

We argue that successful policy-making at the regional level utilises indicators to **construct** transformative change (e.g. in the assessment of which projects to fund, which activities to become engaged in, which technologies to explore further etc.) rather than to simply follow an alleged "best way". This does not preclude, however, that agreeing on a harmonised set of indicators to be collected at regional level across Europe would be valuable, because any analysis of a region's developmental situation requires – today more than ever before – comparison with external points of reference.