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## Globalisation and New Collaborative Working Environments

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### WP3 Deliverable 3.1: NEW GLOBAL Survey Design and Instruments

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# 1 OBJECTIVES OF THE BUSINESS SURVEY

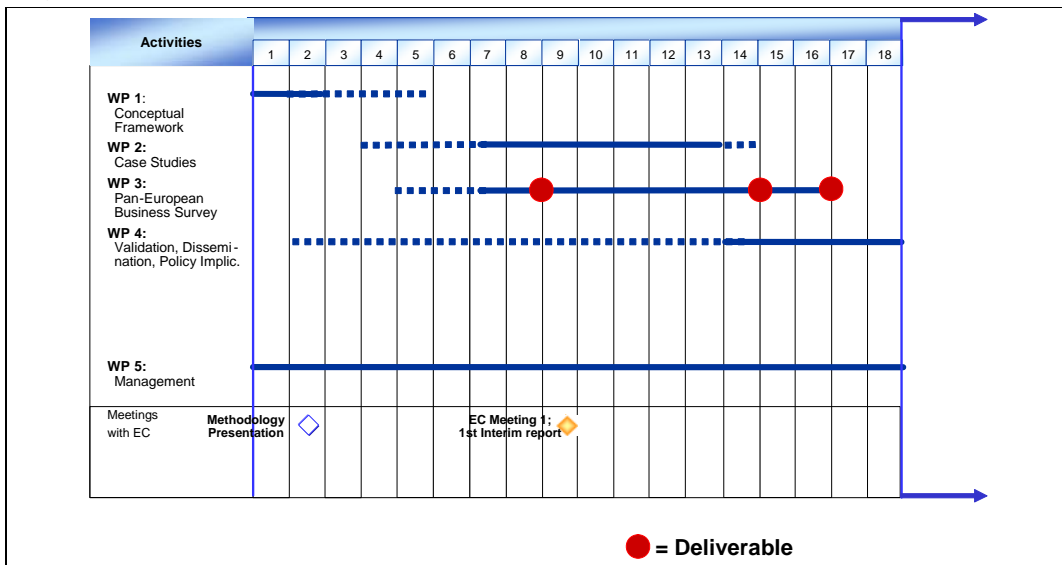
In parallel to the case study research, a representative survey of EU businesses in sectors prone to globalisation will be conducted. While case study research allows for in-depth, qualitative analysis of the functioning of organisations as work systems, the business survey will provide a representative picture of the spread of new, ICT-based collaborative working environments (NWE) and elements thereof in Europe, and will also produce data which can be subjected to multivariate statistical analysis in order to arrive at robust evidence about the impact of ICT-enabled collaboration on key performance measures. Such evidence is as yet missing, which severely limits the capability of policy-makers to promote the advantages of cross-border collaboration and NWE.

The main objective of the survey is to provide representative data about the **spread of NWE** and **cross-country NWE**, as well as elements hereof, among EU companies in sectors which are likely to be significantly affected by globalisation tendencies of high-qualified knowledge work. For this purpose, a representative business survey will be conducted in a **selection of sectors and EU countries**. The data thus collected will allow the study to shed light on the current situation in the EU with regard to NWE, as well as related **drivers, success factors** and **impacts on performance, innovative activity and work quality**.

Deliverables and timing of the WP, as currently planned, are as follows:

- D3.1: NEW GLOBAL Survey Design and Instruments (August 2007)
- D3.2: Second Interim Study Report, Part B: Initial Findings from NEW GLOBAL Survey (February 2008)
- D3.3: Draft Final Study Report, Part B: Consolidated Findings from NEW GLOBAL Survey (April 2008)

Figure 1: Project timeline and WP2 deliverables



## 2 GAPS IN AVAILABLE STATISTICS

### 2.1 The Subject of Measurement

The focus of this section is on policy indicators, i.e. statistical measures which can be used for informing the policy-making process at regional, national or EU level. The chapter will not delve in any depth into organisation-level “key performance indicators”. Rather, it will propose a framework for measurement and a concise list of policy indicators on the spread of new, collaborative work environments (NWEs) and their direct impacts. Before discussing required and already existing statistical measures for NWEs (sections 2 and 3), in the following we will briefly recall the NewGlobal definition of NWEs applied throughout the research in WP3.

Because of the big amount of research into eWork and how to measure it, and because of the fact that the concept of NWEs embraces some of the constituent features of eWork, it appears most useful to start defining NWEs by reviewing the common understanding of key characteristics of eWork.

eWork is understood to comprise any type of telemediated remote work and includes the following types:

- eWork in individualised as well as shared-office based work settings. This refers only to the physical workplace of the worker, not to the question whether they share an office with collaborators/principals or not.
- collaborative work (virtual collaboration, virtual teams) and work which is performed in the context of principal-agent type relationships ;
- work interaction which is inter-organisational, i.e. coordinated over the market (such as in client/contractor relationships and freelance work) and work interaction which is intra-organisational, i.e. coordinated internally in organisations .

This definition of eWork also includes phenomena such as virtual organisations and eOutsourcing. Table 1 presents a typology of eWork, based on previous work by Huws & O'Regan (2001) and Hanhike & Gareis (2004). The grey cells contain the main types of eWork, while the last row lists some types which do not fall in the eWork category.

In order to distinguish between traditional notions of telework on the one hand, and work in NWEs on the other hand, it is possible to draw a boundary between principal-agent type coordination relationships (which are typical for telework as understood by most observers) and collaboration (which is the coordination mechanism typical for NWEs). Accordingly, the bold line in the table marks out the definition of NWEs deployed in this document.

The research carried out in these areas, when related back to the term “new work organisation”, allows us now to list the dimensions which are needed to define the subject of our analysis (NWEs) by using six dimensions: collaboration, spanning of boundaries, team and project organisation, ubiquitous access to resources, people focus and technology:

- **Collaboration**: Collaboration occurs when two or more people interact and exchange knowledge in pursuit of a shared, collective, bounded goal. Bounded goals imply a beginning and an end. Two people interacting in order to get smarter is not collaboration. However, two people interacting in order to prepare for a calculus exam is. For empirical research, this definition needs to be operationalised. We suggest that one should speak of collaboration only when an explicit (e.g. written, but not necessarily legally binding) agreement about common aims has been made. It is important to distinguish collaborative work contexts from other forms of coordination (see Laso Ballesteros & Salmelin 2005).. In this context it appears useful to refer to the typology of coordination modes in the context of workflow processes: These are, ranked according to increasing interdependency: pooled/additive, sequential, reciprocal and intensive interdependence arrangements. These types also relate to the extent to which co-workers carry out tasks in parallel, sequentially, or together. Depending to the extent

to which tasks are designed as business processes, the two last types (reciprocal and intensive) are most likely to fit our understanding of “collaboration”. However, sequential coordination can also amount to collaboration if co-workers interact and exchange knowledge in pursuit of a shared, collective, bounded goal.

Table 1: Typology of eWork, and distinction between definitions of eWork and NWEs

		Coordination mechanism			
		Principal/agent		Collaboration	
		intra-organisational	inter-organisational	intra-organisational	inter-organisational
Work environment	Individualised eWork (away from office premises)	Telework in employment relationships	Freelance telework <sup>1</sup>	Work in virtual teams composed of teleworking employees from a single company	Work in virtual teams made up of teleworkers from different companies (or self-employed)
	eWork on shared office premises	eWork at other site of same company (e.g. back offices)	eOutsourcing	Work in virtual teams composed of employees from a single company	Work in virtual teams composed of employees from different companies
	Non-eWork (examples)	Employed agents co-located with principals	Self-employed co-located with clients	Work in co-located teams composed of employees from a single company	Work in co-located teams composed of employees from different companies

Source: based on Huws & O'Regan (2001), Hanhike & Gareis (2004)

- **Boundary spanning:** An important aspect in which virtual collaboration differs from traditional forms is the extent to which it crosses boundaries of space, time, function, culture, and organisation. This stems from the initial rationale behind virtual collaboration which is to combine the skills and capabilities of a number of agents for the pursuit of a certain goal regardless of the traditional constraints of distance. Mobility – in any sense of the term – plays a key role in this regard. With regard to the geographical boundaries, NWEs typically involve the transfer of work inputs and/or outputs via data telecommunications links across distance. Distance refers here to physical remoteness between collaborators. Remote work most often is being (implicitly) defined as meaning different sites/locations/addresses. A special case, of most interest to NewGlobal of course, are collaborative work relationships which cross national borders.
- **Team and project organisation:** We define collaboration in virtual teams as a group of individuals who (or: some of whom) are located remotely from each other and who collaborate, and in which interaction takes place exclusively or almost exclusively via telemediation. Virtual collaboration is understood to take place in teams, i.e. in groups of persons who work together for a longer stretch of time. A project is a temporary endeavour being undertaken to create a unique product or service. Projects are temporary. In recent years, cases of (virtual) collaboration between companies and their customers have attracted increasing interest (Voß & Rieder 2005). It can be argued that this is also a case of NWE (see Stanoevska-Slabeva et al. 2005). It is not covered by this document's scope, though, as the instruments of marketing research appear to be better suited for researching the subject.
- **Ubiquitous access to resources:** New work environments do not only provide advanced possibilities for interacting with remote collaborators, they also offer anytime, anywhere access to resources such as access to codified information in databases, and digital

<sup>1</sup> For persons who conduct the major part of their work through networked work environments, we can use Laubacher and Malone's term "eLancer" (Malone & Laubacher 1998).

applications (often containing ambient intelligence) which effectively support the adaptation of the working environment (tools, etc.) to the requirements of the specific task on hand. Ubiquitous access to information resources turned from science fiction into a realistic perspective with the advent of the Internet. IP-based applications are likely to dominate NWE tools in the near future.

- **People focus:** Depending on the complexity and nature of the tasks involved (see further below), NWEs need to provide optimal working conditions for the worker if they are to support high levels of productivity – as research into high performance work organisation and related concepts has shown. Worker focus usually implies some or all of the following characteristics: a non-hierarchical organisational structure; flexibility in working methods; corporate cultures focussing on people orientation; continuous investments in learning & training; and innovative performance measurement and reward schemes. In addition, people focus goes beyond catering for workers as it also implies that the focus of business processes should be on optimally serving the customer.
- **Technology:** The type of collaboration outlined above is possible only with the support of advanced tools for, for example, computer supported collaborative work (CSCW); for mobile communication and for ambient intelligence. In essence, these tools enable easy access to knowledge resources and required communication channels at any place and any time, and are fully integrated in the working environment in order to support creative work as good as possible.

In the following we will discuss some of the main elements deemed necessary for measuring spread and impacts of New Work Environments. Section 2.3 then focuses on how the present set of standardised data on work organisation (collected by the European Statistical System and related agencies such as the European Foundation for the Improvement of Living and Work Conditions) cover these phenomena. This will enable us to make suggestions about how the existing indicators and data collection mechanisms can be extended/modified to take account of the importance of virtual collaboration and NWEs for the competitiveness of the European economy.

## 2.2 Indicator Requirements for Measuring Global NWE

### 2.2.1 Generic requirements

#### *Types of Indicators*

An issue of particular importance with regard to indicators for the Information Society is the question of relevance. It has been argued that most statistics available until now mainly focus on the conditions and take-up of ICTs, while a more holistic assessment of the Information Society requires a shift of attention towards the ways (and the ends to which) ICTs are used, and societal outcomes. This is also true with regard to eWork and other phenomena related to NWEs.

Following Eurostat (see Gärdin 2002), we define these groups of indicators as follows:

**Readiness indicators** indicate the potential for use of ICT and describe variables such as ICT infrastructure, access to and availability of Internet, email, PCs and IT-skills. In a wider sense one could also include what was termed “drivers for change” above, i.e. company external factors which drive organisations to take up NWEs.

**Intensity indicators** indicate the actual use and applications of ICT and describe variables such as ICT investments, the extent of use of Internet, email, PCs, e-commerce, for what purpose they are used by different user groups – people and households, businesses and government. In a wider sense, what is called value drivers or management levers above can also be subsumed under intensity indicators insofar as these factors are decisive for the intensity with which the organisation adapts to the requirements of NWEs.

These two families of indicators represent the basic indicators for the Information Society and typically provide the main basis for cross-country benchmarking and analysis of the digital divide. They relate mainly to the infrastructure and the transfer of possibilities and participation of the people. The following two families of indicators relate to economic and social changes.

Impact indicators relate mainly to the micro level, enterprises and governments, but also to the industry level. They describe

- new ways of organising work, referring to the relations between individuals as well as between individuals and the enterprise;
- new ways of organising production, which refers i.a. to inter-enterprise relations such as outsourcing, joint ventures, licensing etc;
- knowledge supply/human investment/human resources;
- mobility;
- innovation/R&D and spin-offs.

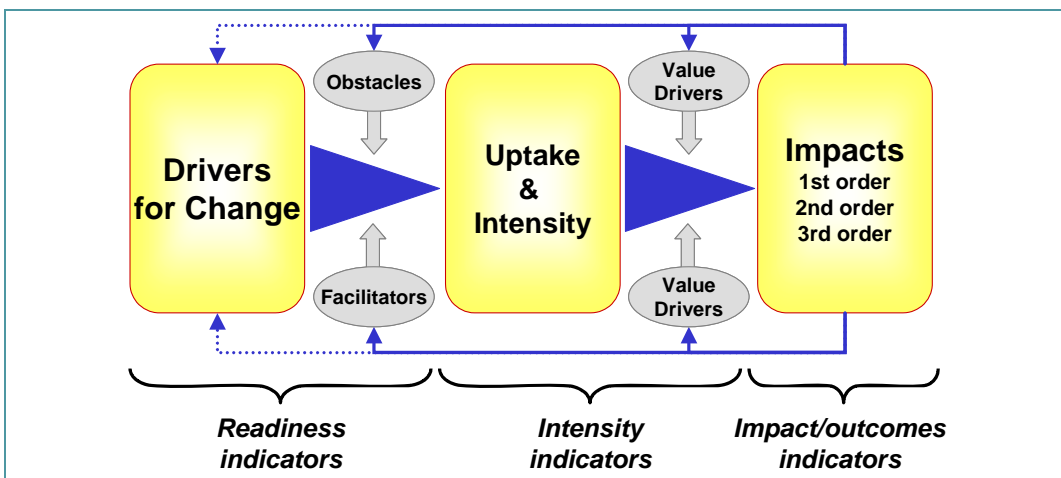
Outcome indicators relate mainly to the macro or societal level and describe

- economic growth, productivity and competitiveness;
- employment and the labour market;
- social inclusion and participation.

It is on the latter level the issues about sustainable economic development can be approached. However, the factors measured by impact indicators do of course directly affect the variables measured by outcome indicators. As such, both are strongly related.

For the purpose of this document, a clear distinction between impact and outcome indicators is not useful because depending on the level of data capturing, the latter are often simply aggregates of the former. For a more detailed discussion see below.

Figure 2: Factors affecting uptake of NWEs and their impacts, and types of indicator needs



Source: Gareis 2006

Figure 2 shows the relation between types of indicators, as discussed above, and the main elements which have been identified in earlier stages of the research as of relevance for the topic of NWEs. Making sense of NWEs, and of the role policy-making can play in guiding the ways these are applied across the European economy, will require sufficient statistical coverage of these aspects. Ways how this goal could be reached will be discussed in the remaining parts of this document.

### 2.2.2 *Readiness Indicators*

A number of factors can be identified which tend to drive the development and implementation of NWEs. Because of the general nature of many of these factors, the following discussion will only deal with readiness indicators which are of specific relevance to the diffusion of NWEs.

#### *Technological infrastructure*

In general, the technological infrastructure requirements for uptake of NWEs are very much related to the development of anywhere/anytime potential or actual access to a high quality Internet connection. High quality, in this context, means broadband Internet – although narrowband access remains of some relevance for highly mobile access, e.g. through 2G or 2.5G mobile phone networks.

Because of the central role of mobility in the concept of NWEs, indicators need to cover conditions for:

- access at the main workplace(s);
- access at other sites of the same organisation (if applicable);
- access at home;
- access at mobile locations.

The latter may mean near-ubiquitous mobile broadband access through 3G networks, or punctual access through local WiFi networks or public Internet access points (PIAPs).

Because of the pace of techno-economic change, indicators in this area need to be carefully constructed to ensure that they stay relevant over an as long stretch of time as possible. This may also imply that the definition of broadband in the sense of bandwidth needs to be adapted dynamically to industry standards. Alternatively, measurement could focus on the applications used most widely for collaborative purposes (e-mail, voice over IP, video-conferencing, application sharing etc.) and then analyse to what extent these are available at different types of work locations.

#### *Firms: Co-operation, collaboration, teamwork, staff physical mobility*

Organisations differ with regard to the need for collaboration and the potential effects thereof on performance and short and long term competitiveness. In general it seems fair to assume that organisations that operate in an area which is traditionally characterised by large degrees of co-operation and inter-firm networking are more likely than the rest to take up virtual collaboration and NWEs. They are also more likely to have acquired the necessary know-how and skills which are needed for managing intra-firm partnerships and collaboration. For these reasons, the overall degree of inter-firm co-operation and collaboration is a key readiness indicator for NWEs.

For these phenomena, organisation/firm-level indicators are required. In addition, collaboration intensity and complexity need to be measured at the level of the individual worker/workplace, which is the level at which NWEs are being implemented. Here, collaborative working inside of organisations is of as much importance than collaboration across the boundaries of the firm. Involvement in team work and work organised in projects are indicators for the readiness of a worker to take up work in virtual teams and modes of virtual collaboration.

Collaboration complexity is of vital interest, too, since experience in more complex types of working in teams and projects is likely to improve the skills needed for ICT-mediated collaboration. Collaboration complexity is the type and character of such relationships and

their strategic role for the organisations involved. Factors of what in this context has also been called “people complexity” include:

- Team scope: Whether the team stretches across organisations or includes staff from one company or even site (establishment) only.
- Team size: More people means more communication – and exponentially so as potential conversations rise with the square of the numbers of people.
- Duration and team member turnover: Long-term teams tend to operate radically different from short-term teams. A high member turnover tends to reduce the effects of long-term team stability.
- Cultural diversity: Team members from different cultural areas (such as countries) imply challenges to communication due to different languages, values, norms etc.
- Geographical distance: Large distances between team members make it more difficult to meet face-to-face, with implications for interaction patterns and group cohesion.
- Group cohesion: Groups in which no common beliefs, goals and loyalties have been agreed upon are harder to manage. Low cohesion means that more effort needs to be invested on striking an acceptable balance between the different interests of group members. Moreover, more formalised systems for rewarding goal consistent behaviour may have to be installed.
- Power balance: Groups with an established power balance between members are less complex than groups in which different members/segments strive for changing the power balance.
- Personalities of team members: Empirical research has shown that the extent to which personality styles are suitable for working in teams differs; and that the mix of personality styles in a group matters a lot (Potter & Balthazard 2004).

A final factor to be mentioned here is physical worker mobility. Workers whose job requires them to be physically mobile are more likely to be affected by developments in the area of virtual collaboration than others. This is mainly for the reason that physical mobility, without exception, involves sizeable costs – what Perry & Brodie (2006) call “mobilisation costs”. Decreasing these costs (while at the same time boosting the value generated through mobile work) is one of the main driving forces behind the development of applications for mobile collaborative work environments.

Firms which traditionally deploy physically mobile staff are also likely to have a different attitude towards virtual forms of collaboration compared to firms which use ICT-based collaboration in order to become geographically more mobile. Degrees and patterns of physical worker mobility are necessary statistical indicators for analysing NWE readiness.

### *Skills*

NWEs put high demands on the generic skills of workers. Felstead et al (2002), through In-depth analysis of the UK Work Skills Surveys, identified ten categories of generic skills and how these can be operationalised. In Table 2 the relevance of each of these ten skill categories for NWEs is discussed in brief.

To summarise, as far as readiness indicators for uptake of NWEs are concerned, four categories of skills are of most importance: digital skills, communication and collaboration skills, self-management skills and problem identification/solving skills.

In addition to the current endowment with NWE-related skills, access to and utilisation of offers for continuous, lifelong learning and training are of prime relevance. This is because today in the future, skills will become outdated faster than ever before. Constant renewal and updating of work-related sets of skills is therefore becoming a core requirement for keeping workforces adaptable to the increasing speed of change in working tasks and environments.

Table 2: Skills categories of particular relevance for NWEs

Skills category	Description	Relevance for NWEs
<b>Literacy Skills</b>	Both reading and writing forms, notices, memos, signs, letters, short and long documents etc.	Mainly of relevance in the context of written communication through electronic channels (see below)
<b>Physical Skills</b>	The use of physical strength and/or stamina	Low relevance
<b>Number Skills</b>	Adding, subtracting, divisions, decimal point or fraction, calculations etc., and/or more advanced maths or statistical procedures	Importance for interpreting and processing computer-generated information (Levy & Murnane 2004: 103-105)
<b>Technical 'Know-How'</b>	Knowing how to use tools or equipment or machinery, knowing about products and services, specialist knowledge and/or skill in using one's hands.	Computer-related skills ("digital skills") are of prime relevance for NWEs. The degree to which specialist know-how is needed is, of course, dependent on whether and how the supply-side will make progress in usability.
<b>High-level Communication</b>	Top-down communication skills, including persuading or influencing others, instructing, training or teaching people, making speeches or presentations and writing long reports. This skill is also linked to the importance of analysing complex problems in depth.	Some relevance as NWEs and virtual teamwork will mean that a higher share of workers will be carrying out management tasks.
<b>Client Communication</b>	Selling a product or service, counselling or caring for customers or clients.	No specific relevance
<b>Horizontal Communication</b>	Working with a team of people, listening carefully to colleagues.	Very high relevance and interrelation with "technical know-how"
<b>Planning</b>	Planning activities, organising one's own time and thinking ahead.	Very high relevance (self-management)
<b>Problem-Solving</b>	Detecting, diagnosing, analysing and resolving problems	High relevance for work in virtual teams as responsibility is distributed more evenly across workers.
<b>Checking Skills</b>	Noticing and checking for errors.	High relevance for work in virtual teams as responsibility is distributed more evenly across workers.

Source: First two columns from Felstead et al. (2002: 34)

The indicator needs in this area have been defined in a number of documents, including European Commission policy papers. For inclusion as readiness indicators in an indicator system for NWEs, the total uptake and intensity of work-related lifelong learning are of most importance. In addition, provision and financing arrangements as well as total investments in training should be measured, since these indicate the degree to which (a) companies invest in lifelong learning of their staff and (b) workers themselves take responsibility for their own learning.

In addition to engagement in training measures (= structured, purposeful learning), recent years have seen some of the attention shift to incidental, experiential, non-structured training (Dohmen 2001, Tuomi 2006). Incidental learning is very hard to measure in survey research, as the experience of Livingstone (2001) shows. It appears that the best way to do so is to avoid focussing on the learning process itself, as this is elusive and often taking place unconsciously. Rather, a measurement could focus on the (perceived) ability of the working environment to enable and induce learning: what might be called the extent to which a workplace is enabling experiential learning.

*Attitudes and awareness of the benefits of new work organisation and (virtual) collaboration*

Awareness of the possible benefits of collaboration can be seen as a necessary condition for uptake of (more complex types of) NWEs. The same applies to awareness of the possible benefits of pro-active work organisation (see above), as both are considered to be closely related in the definition applied for the purpose of this paper.

In both cases, awareness of potential advantages to be achieved needs to be analysed against the context of a firm's strategic plans and the market area it operates in. Strategic goals which are likely to have a major effect on whether a firm can expect potential benefits to be obtained from NWEs include:

- to improve the innovative capacity of an organisation;
- to create more flexible configurations of human capital (task-specific, temporary combinations of core competencies);
- to improve time-to-market and/or time-to-action;
- to organise R&D and/or production on global scale (economies of scale) while preserving/creating economies of scope;
- to improve the responsiveness to client needs;
- to get access to labour markets which have been out of reach before;
- to offer valued members of staff more attractive working conditions;
- to enable cooperation with remote high-qualified staff or sub-contractors.

Readiness is also affected by the type and strength of obstacles perceived by decision-makers in firms.

At the level of individual labour force members, attitudes towards entrepreneurship (which does not necessarily have to imply self employment) are a good indicator of readiness for the willingness to work in a position which involves high self-responsibility and job autonomy.

*Firms: Participative organisation*

Confusingly, many accounts of technology-related organisational change make the assumption (implicitly) that more participative, decentral forms of work organisation follow from implementation of technology. Most evidence, however, suggests that the causal relationship works the other way around: Technology has the most beneficial effect in situations in participative organisations (OECD 2003).

It is important to distinguish between different types of participation, as they have distinctly different implications for the way in which decision making is executed in practice. Following the EPOC study (see Sisson 2000: 3) we can distinguish between:

- Individual consultation: 'Face-to-face': arrangements involving discussions between individual employee and immediate manager, or 'arms-length': arrangements which allow individual employees to express their views through a 'third party',
- Group consultation involving 'temporary' groups who come together for a specific purpose and for a limited period of time, or 'permanent' groups who discuss various work-related topics on an ongoing basis.
- Individual delegation: Individual employees being granted extended rights and responsibilities to carry out their work without constant reference back to managers (e.g. 'job enrichment').
- Group delegation: Rights and responsibilities are granted to groups of employees to carry out their common tasks without constant reference back to managers (e.g. group work).

### 2.2.3 Intensity Indicators: Uptake of NWEs and Value Drivers

#### Dimensions of NWEs: Introduction

The newer work environment literature gives insights into the factors to be considered when assessing NWEs. These need to form the basis of any attempt to benchmark NWEs and their impacts on the economy and society.

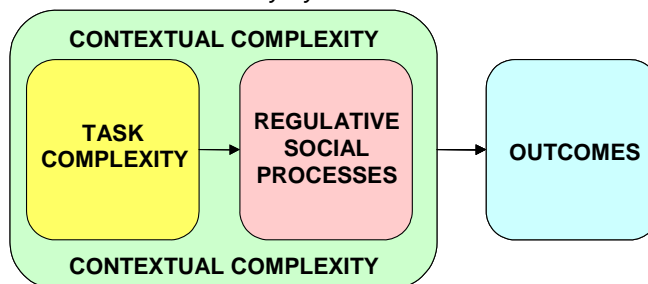
Shah and Pritchett (2004) distinguish between three groups of aspects:

- "physical aspects (including spatial, topological, parts-whole and other physical relations amongst environmental elements which the agents need to know to be able to accomplish the physical task);
- functional aspects (including task structures, means-end structures), and
- social aspects (including the distribution of desires, goals and capabilities amongst the agents)."

This relates to the model by Vartiainen (2006) who, based on the elements of Activity Theory (Engeström 1987), distinguishes between three basic features of collaborative work systems which need to be analysed in order to obtain proper understanding of all issues involved, and which together account for the outcomes of the work system in question, such as social and economic impacts:

- the complexity of collective joint tasks (task or job complexity);
- the complexity of context or space (physical, virtual, regulatory) where a team of collaborators is operating;
- regulative social processes involving individual or collective subjects (e.g. interconnectedness, trust, desires, common goals, etc.).

Figure 3: Networked work as an activity system



Source: Based on Vartiainen (2006)

In the following we will discuss, for each of these four areas, requirements for core indicators, making reference to established measurement approaches wherever possible.

#### Task Complexity

Indicators for task and job complexity are required, since a high task complexity is expected to make it more difficult to execute task interfaces via electronic communication channels – at least under the assumption that these are characterised by low media richness, such as in the case of e-mail. Different indicators have been developed and piloted for describing the complexity of work tasks. They often make use of scales with one or few dimensions, since these are preferred in survey research. An example is the indicator applied in the European Working Conditions Survey (conducted since 1990 in five-year intervals by the European Foundation for the Improvement of Living and Working Conditions), which measures work complexity using a two-dimensional scale:

- 0=Monotonous tasks, no complex tasks

- 1=Both monotonous and complex tasks
- 1=Neither monotonous and complex tasks
- 2=Complex tasks, no monotonous tasks.

Closer inspection reveals, however, that task complexity is composed of a larger number of dimensions. For this reason measurement either requires in-depth comparative research or is burdened by problems of validity of measurement. The main elements which need to be taken into account for assessing job complexity include the following :

- Number and variety of tasks: The more different things there are to do, the more complex managing the job as a whole is. If there are lots of similar tasks, then similar tools, management methods, etc. may be used.
- Variability of tasks: If tasks change often and unpredictably, managing them becomes more difficult.
- Difficulty of tasks: Routine tasks are considered easy to carry out, although they may require highly specialist knowledge (i.e. they are only easy to carry out for somebody who is properly trained for the task). More difficult tasks require greater attention and have more ways to fail. It also makes it more difficult to verify.
- Nature of knowledge required: Tasks which require tacit knowledge are harder to manage than tasks which are based on codified knowledge input. Creativity is an example of know-how which is particularly hard to codify.
- Verifiability of work: If you cannot see what has been done, then it is difficult to track progress and check that things are done correctly.
- Location-specificity of tasks: Tasks which can only be carried out in a certain place or type of place make coordination more difficult.
- Interdependencies between tasks: When one change depends on others or can affect many things, coordination is more complex than when changes are independent of one another.

Vartiainen in his survey research uses five categories of task complexity: "Team members' jobs consist of both routine and complex tasks. Please, think of your job as a whole and evaluate, how many percent of your job includes tasks with different demands named below so that their sum is 100%. My job consists of ...% (sum should be 100%)

- doing routine tasks;
- working based on familiar rules and guidelines;
- applying rules and guidelines in many familiar contexts;
- combining familiar rules and guidelines in new contexts;
- creating new plans and solutions."

More research is required to construct simple, valid indicators for measuring task complexity across the whole workforce through labour force surveys.

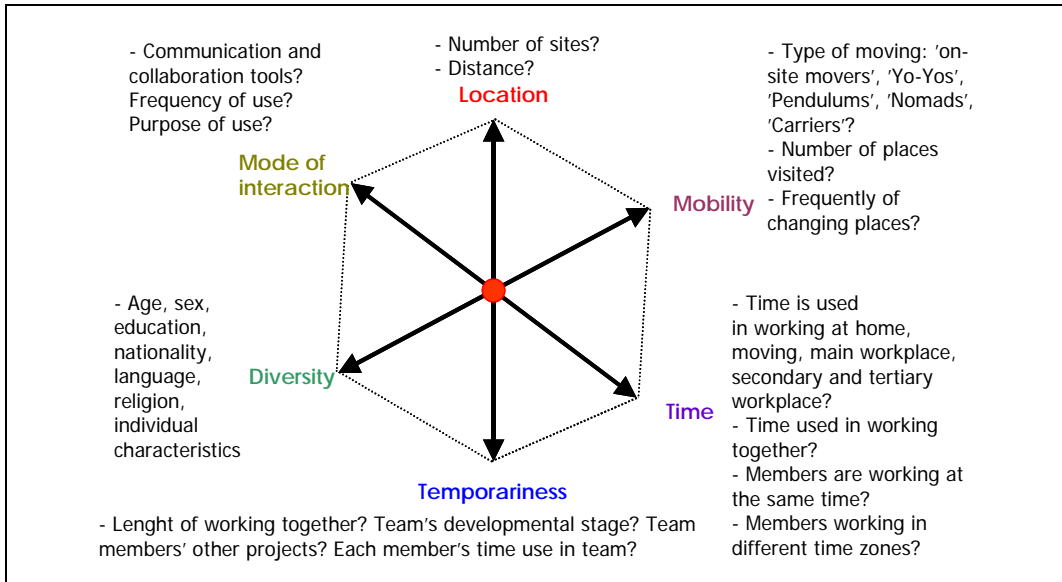
#### *Contextual Complexity: Mapping NWEs*

Vartiainen (2006) identified the following six dimensions which determine the contextual complexity of a work system that includes collaboration. He distinguishes between (see Figure 4):

- (a) Location: actors are working in a same location face-to-face or geographically dispersed in different places. A part of team members or teams in a project are working one place and a part in different places.
- (b) Mobility: actors may be physically mobile and change their workplaces or they stay in a fixed place working mainly in one location.

- (c) Time: actors work either synchronously or asynchronously in different time zones or sequentially in a same time zone. In addition, actors work only for one team or project or divide their time between several teams and projects.
- (d) Temporariness: the collaboration of actors and their social structure may be permanent or temporary. Most of teams are projects having their life cycle.
- (e) Diversity: the background of actors, i.e. their age, education, sex, nationality, religion, language, etc, is more or less similar or different.
- (f) Mode of interaction: communication and collaboration take place directly face-to-face or mediated via different media and technological systems.

Figure 4: Physical, virtual and mental context features of work systems



Source: Vartiainen (2006)

### Regulative Social Processes

Following Vartiainen (2006), we differentiate between the following types of regulative social processes which are highly relevant for any process of NWE implementation, as they influence success as well as all other impact dimensions of NWE uptake.

- **Fairness:** Workers' perception of the extent to which decisions are made in an unbiased way, based on accurate information, and involving all those who are likely to be affected. In addition, elements of perceived fairness include consideration, kindness, respect and truthfulness in the treatment of oneself by co-workers and superiors; and the extent to which resources and rewards are distributed fairly according to work performance, effort invested, and stresses and strains endured.
- **Control:** The extent to which each team/project/unit member's work progress and performance is monitored.
- **Trust:** The extent to which persons believe that the motivations of co-workers etc. towards them are benevolent, "honest", truthful, reliable, considerate, amicable, dedicated, competent, careful. In a wider sense, the concept of trust can also be extended to include trust in technological appliances such as computers.
- **Team spirit:** The extent to which team members have joint interests and values, and to which they consider that the team's success is their own success.

- Leadership: Workers' perception of the effectiveness and efficiency of team/unit leadership, as reflected in: dealing with problems, support of employee's career development, allocation of workload and resources, guidance to staff members, team development and support of team cohesion, information flows, joint decision-making, monitoring.
- Goals and motivation: The extent to which goals and objectives are properly defined, planned and communicated within the team/project/unit, and to which these are shared by all team/project/unit members. In addition, the degree to which resources are sufficient to allow goals to be reached, and the feeling by all co-workers of being motivated for jointly working in order to reach the goals defined.
- Cooperative behaviour: The willingness to invest in helping co-workers without the formal obligation to do so.

It is important to note that these factors are neither purely causes nor simply outcomes of applications of NWEs. Instead, regulative social processes, task complexity and contextual complexity are mutually interdependent factors.

#### 2.2.4 Impact / outcomes indicators

##### *First Order Outcomes – Processes, Productivity and Performance*

First order outcomes are, first of all, the effects of NWEs on traditional performance measures including labour productivity at workplace, team or firm level, total factor productivity, gross rates of return and Tobin's q at firm level, throughput times at individual or team level, and time-to-action or time-to-market at team or firm level, to name the most established. Newer concepts which try to take account of the nature of modern business processes and industry structures include value chain productivity. The level of pay/remuneration (which needs to be put in relation to total working hours) should also be considered as outcome indicator.

Quality measures play an increasingly important role not only as secondary, but as core performance indicators. Output quality can be measured in a number of ways – more or less well – depending on the type of product at hand. In heavily customer focused market segments, customer satisfaction can be a 1st order outcome indicator, as well.

For organisation which are heavily relying on innovation to maintain competitiveness, the level of innovative activity is a further 1st level outcome indicator, as is capacity to change, which denotes the ability of an organisation (or part thereof) to adapt flexibly to changing market conditions (in the widest sense).

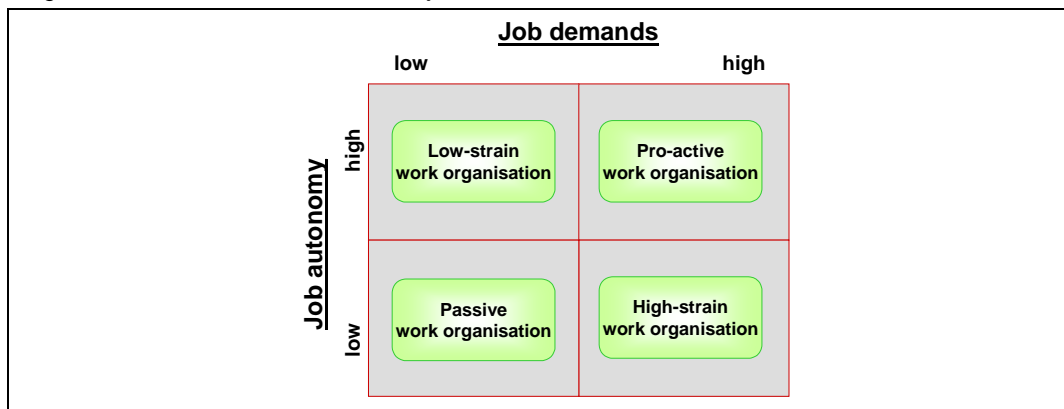
The exact choice of performance indicators depends, of course, on the type of product and sectoral environment the organisation is operating in (see Appelbaum et al. 2000).

##### *Second Order Outcomes – People and the Social Structure of the Organisation*

Second order outcomes concern, in particular, effects on the quality of work from the viewpoint of workers. Established outcomes indicators for job quality include, apart from levels of pay/remuneration (see above), job satisfaction and the existence of negative impacts on worker health.

The extent to which staff has a say in decisions which affect their work (participation) has been identified by recent research as having a direct influence on job satisfaction. The same applies to job autonomy. It is necessary, though, to put job autonomy (task discretion) in relation to job demands (workload, work strain): Recent research has shown that the relation of both decides about job satisfaction, and economic sustainability (see Figure 5).

Figure 5: The “time constraints ⇔ job demands” model



Source: Gareis (2006), adapted from Karasek/Theorell 1991; Dhondt et al. 2002

Combinations of high (albeit not excessive) job demands with high job autonomy are referred to as pro-active work organisation. They are typically associated with high work motivation which has proven to be a core factor in any attempt to permanently increase labour productivity in high-qualified knowledge-based occupations.

High-strain work organisation is usually associated with stress, which is defined as an event which a person perceives as important with respect to his/her goals, but which at the same time exceeds his/her capabilities (Richter et al. 2006: 234).

Low-strain and passive work organisation, on the other hand, are often associated with workers being/feeling overqualified for the job they do. This is not only a waste of resources from the society’s point of view, but also negatively impacts on job satisfaction. A good match between jobs characteristics and worker characteristics must be regarded as a key goal of labour market policies.

Perceptions of job security is another, often used indicator for job quality. Against the background of labour market paradigms gradually shifting from “life-time employment” towards “life-time employability”, job security appears to be of decreasing relevance for gauging quality of work at the aggregate level. For this reason, an indicator on perceived employability, i.e. perceived individual labour market opportunities appears to provide better value.

The recent emphasis in the public debate on the issue of work/life balance means that more attention is being paid today to the effect of working conditions on life satisfaction or, more generally, happiness (subjective well-being). Indicators for work/life balance are hard to define without resorting to overcome notions of what is (or should be) important in life (such as family, children, civic participation etc.). Such indicators may make sense from society’s point of view (see following section) but should be avoided when analysing personal outcomes of work. A more non-judgmental indicator would have to focus on the extent to which work limits individuals to use their spare time for the things which are most important to them.

At the level of the team/group/unit level, secondary outcome indicators need to include measures of social capital, such as the degree to which (different types of) trust are being perceived among team members. The notion of social capital also includes team and goal cohesion, perceptions of effective leadership and co-operative behaviour. Care needs to be taken, since these variables can be outcomes of changes in work organisation as well as they can be causes or integral components of such work-related change. It may, therefore, be better to regard them as intermediate factors which need to be taken into account in any analysis of the preconditions, intensity and impacts of implementations of NWEs. Care needs to be taken, since these factors can be preconditions as well as outcomes of the

implementation of NWEs. Here, they are featured under the subsection “Regulative social processes”.

At the firm level, secondary outcomes which have been identified in the companion document include impacts on an organisation’s ability to manage its knowledge. This applies, in particular, to configurations of human capital which are short-term, temporary and at-arms-length all at the same time. In these cases, knowledge management can be expected to be negatively affected unless innovative solutions are implemented to counteract such tendencies. Further firm-level outcome indicators need to cover changes to a firm’s (longer term) innovative capacity. Both indicators are extremely difficult to translate into policy indicators. More research in this area will be necessary.

Apart from these, additional firm-level outcome indicators can be seen as aggregates of the individual and team-level aspects discussed above. For example, total rates of absenteeism are directly related to health effects at the workplace level, albeit also influenced by external factors such as job insecurity and intrinsic motivation.

### *Third Order Outcomes – Societal Outcomes and Sustainability*

At the level of society, we can distinguish between the following broad spheres which are likely to be affected by the implementation of NWEs:

- the labour market and employment structures (available jobs and their allocation across sectors and occupations; quality of jobs as measured by levels of skill required and pay);
- the systems of skills acquisition including the formal and informal education systems;
- economic growth (wealth generation);
- public welfare and social cohesion (quality of life at societal level, including long-term environmental sustainability, regional balance, etc.).

With regard to labour market related indicators, total rates of employment as well as unemployment rates are of prime importance as structural indicators for the health of European economies. Because of the well-established fact that women and older citizens are the population groups whose participation in the labour market needs to be strengthened more than anything else, specific indicators should be deployed to measure the effects of NWE related developments on the employment rates of older people and of women. In this context, there is much talk of work/life balance as a challenge which needs to be tackled in order to attract more people into the labour market. An interesting country-level indicator on work/life balance could be the employment impact of parenthood, since it can be used to measure the effectiveness of political initiatives to decouple labour force participation from parenthood for both women and men.

The value of indicators on job tenures appear to mixed: Evidence collected by the OECD (2001) suggests that aggregate numbers tend to overshadow often dramatic change at sectoral and or regional level, and it is anyway much up to debate whether shorter or longer job tenures are more favourable for long-term economic and labour market development. In its place, we suggest to use an aggregate indicator on perceived individual labour market opportunities (see above).

With regard to skill needs and the appropriateness of the structures of skill acquisition (i.e. the systems of formal, non-formal and informal education), more comparable, consistent and relevant indicators on the skill requirements of companies are much in demand. Skill requirements indicators need to detach themselves from existing taxonomies of occupations/ qualifications in order to be more flexible in reflecting shifting demand for skills. This applies, naturally, especially to generic and “soft” skills – the relevance of which for recruiting companies seems to have increased considerably in recent years.

With regard to economic growth, a number of well established indicators are readily available to be used in econometric analysis to single out the effect of NWEs – once better data is

available on uptake and intensity of usage. Examples include total factor productivity growth and GDP growth.

Finally, with regard to public welfare and social cohesion, established social inclusion indicators could be applied. Because of the special relevance which NWEs can have for regional development, innovative indicators may be required to reflect the degree to which there virtual collaboration is being utilised by the centre on the one hand, and by the periphery and rural hinterland on the other hand.

Insofar as environmental impacts of NWEs are concerned, indicators on travel volumes and patterns (such as total miles of work-related travel) and the relation between wealth production and resources consumed for transport) may be required. It will, however, prove extremely hard to disentangle the effect of NWEs on such parameters from other influence factors, as all of these tend to be heavily interrelated.

### **2.3 Existing indicators on New Work Environments and Cross-Border Collaboration**

The European Statistical System, which is made up by the Member States' National Statistical Institutes (NSIs) and the European Commission's statistical agency Eurostat, has in recent years made considerable progress in the establishment of a framework for measurement of ICT related issues, and the implementation of systems for harmonised data collection and integration. As we will see, however, the coverage of issues related to NWE (as defined in NewGlobal) remains sketchy at best. This is confirmed by recent research into availability of indicators on "networkedness", collaboration and co-operation which crosses the boundaries of firms, regions, countries or even continents (e.g. Huws & Flecker 2004; OECD 2005a; Gareis 2006a; 2006b).

A number of other sources of cross-country and national data on related issues exist. These are listed in the Annex to the 1<sup>st</sup> Interim Report (D1.2). They can provide valuable insights into how progress can be achieved in covering issues new forms of work organisation, proactive workplaces and virtual collaboration.

#### *2.3.1 Basic Challenges*

One of the basic challenges with regard to indicator development for virtual collaboration is presented by the very elusiveness of the phenomenon: Whereas traditional notions of (mostly home-based) telework can be operationalised in a straight-forward way (by reference to the working location of a survey respondent), no such clear-cut working definition exists for virtual collaboration.

As a consequence, telework has been subject of much research and is today, as will be shown today, fairly well represented in national statistics, while collaboration at the workplace or team level is hardly covered at all.

#### *2.3.2 Progress in Indicator Development*

##### *Indicators on Telework and eWork*

The question of how to measure telework has been dealt with extensively (Pratt 1987; Gareis 1999; Huws 1999; Gareis & Hüsing 2002; Lilischkis & Meyer 2003) in the last three decades. Because of the availability of good overviews over available indicators and remaining challenges for measurement (Altieri et al. 2005; Pratt 2005; CEC 2005), we will in this report not review the multitude of measuring approaches which have been used for the purpose.

In recent years, telework-related research has not only looked into home-based, ICT-enabled work but also into what has been termed "ICT-supported multi-locational Work" (CEC 2003,

Gareis et al. 2004; Altieri et al. 2005), which exploits the possibility of ICT-based work to fully liberate work from space-related constraints. The term of “multi-locational work” suggests that more and more persons spend working time at more than one or even multiple locations, and work wherever it suits their work tasks, business schedule, and/or lifestyle choices.

The interview asked in detail for time spent at each of five “atypical” working locations. The table now shows the share of those teleworking from one of these locations (columns) who also work at each of the other locations (rows). For example, of persons teleworking from the home (a) 11.5% also work at a second location of their employer and use online connections to stay in contact when doing so. Another example: 42.5% of those who telework from mobile locations (e) also spend time teleworking from home. The figures in the table provide evidence that multi-locational work has indeed become a normal way of working for a considerable share of total employment. It seems that once workers have access to mobile computing equipment, they seem to choose any of a number of different working locations, including a second location of their employer, the premises of customers or clients, hotels and meeting venues, and temporary locations while travelling. This is confirmed by evidence collected through a pilot survey in the STILE project, which developed an eWork module to be included in national labour force surveys (Altieri et al. 2005).

The European Statistical System has not yet taken on board a fully-fledged indicator on eWork, as defined above. The ICT Usage Household Survey used to include a variable on “proportion having undertaken specified work related activities at home, as percentage of all persons having accessed the Internet in the 3 months prior to the survey”, derived from the module:

*Did you use the Internet for work-related activities outside the premises of your employer (e.g. at home) in the last 3 months? (If yes) Which ones? (multiple choice)*

- a) Finding information relating to your work or business
- b) Accessing the employer's IT systems
- c) Communication (exchanging and accessing e-mails)

This question was dropped from the latest survey rounds.

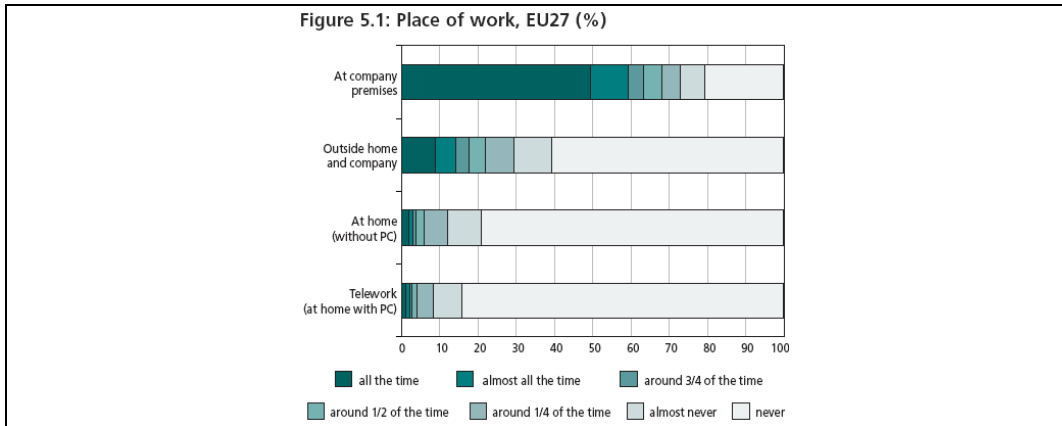
About the use of the Internet at the workplace, the Eurostat master questionnaire includes the following question:

Where have you used the Internet in the last 3 months (using a computer or any other means)?

- At home
- At place of work (other than home)
- At place of education
- At other places (Public Library; Postal Office; Public Office, town hall, government agency; Community or voluntary organisation; Internet Café; Neighbour, friend or relative's house)

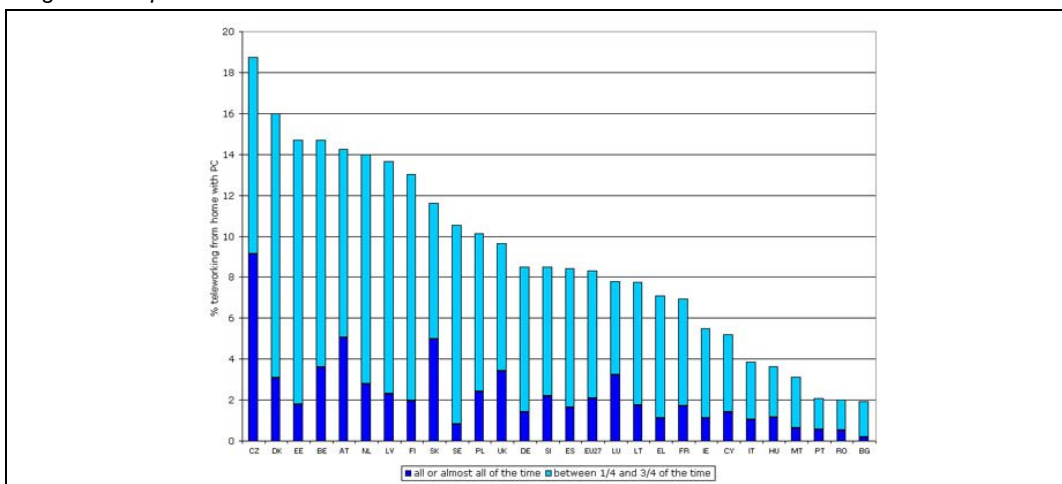
More in-depth data is available from the European Survey on Working Conditions, but this is only carried out once in five years. Figure

Figure 6: Place of work (including homework and telework) in EU27, 2005



Source: European Foundation (Parent-Thirion 2007)

Figure 7: Spread of home-based telework in 2005



Source: European Foundation (Parent-Thirion 2007)

Trends in the spread of telework have most recently been reported by the European Foundation (2007: 9-10), based on national level data collected by a variable (more or less reliable) sources:

*Evidence suggests that the incidence of working away from the place of work and of teleworking is increasing. In percentage terms, workers are more likely to work away from the workplace than they are to telework.*

*In Austria, the number of teleworkers rose from 21,800 personnel in 1997 to 57,800 in 2000, defined as those who work at least eight hours a week from home on a PC. In Portugal, the incidence of teleworking increased from 0.6% of the working population in 1994 to 2.2% by 1998–1999. In the UK, the proportion of teleworkers (defined as those who work mainly in their own home or mainly in different places using home as a base, who use both a telephone and a computer to carry out their work at home) rose from 4% of the workforce in 1997 to 8% in 2005.*

*In terms of homeworking, in Denmark, the number of employees working from home increased from 20% to 24% between 2000 and 2005, according to Statistics Denmark (Danmarks Statistik). Likewise, in Finland, the proportion of employees working at*

home at least occasionally or partly increased from 26% in 1990 to 31% in 1997, remaining at 31% in 2003.

In the new EU Member States, working away from the main workplace has increased over the past decade, following restructuring and the development of the IT and services sectors. This has been the case in Hungary since the early 1990s, with the proportion of people working at premises other than the company premises increasing from 1.3% in 2002 to 2% by 2004. In Poland, although no accurate data are available, the incidence of working away from the workplace is estimated to have increased significantly over the past decade.

In some countries, however, the trend has been downward. In Germany, according to a 2002 study, the percentage of workers working away from the employer's premises declined from 6% in 1993 to 3% in 1997 in western Germany and from 8% to 5% in eastern Germany.

The reason for the diverging trend statistics about the spread of telework is likely to be found in the definitions being used. As Table 3 shows, surveys arrive at very different results depending on the exact definition being used for teleworking.

Table 3: Different indicators on telework, Finland 2002

Opportunity for and interest in distance work, working or attending to business outside the workplace and perception of oneself as a distance worker among employed persons aged 15–64 in 2002

	Men	Women	Total (%)	Total (N)
Distance work is possible at least for a short time	22	21	21	480 000
Attended to business at home outside working hours	14	11	13	298 000
Interested in distance work	12	12	12	274 000
Used the Internet or e-mail for work at home	10	7	8	193 000
Considers oneself at least occasional distance worker	6	5	5	120 000

Source: Nurmela et al. 2004

#### Indicators on Collaboration at Workplace Level

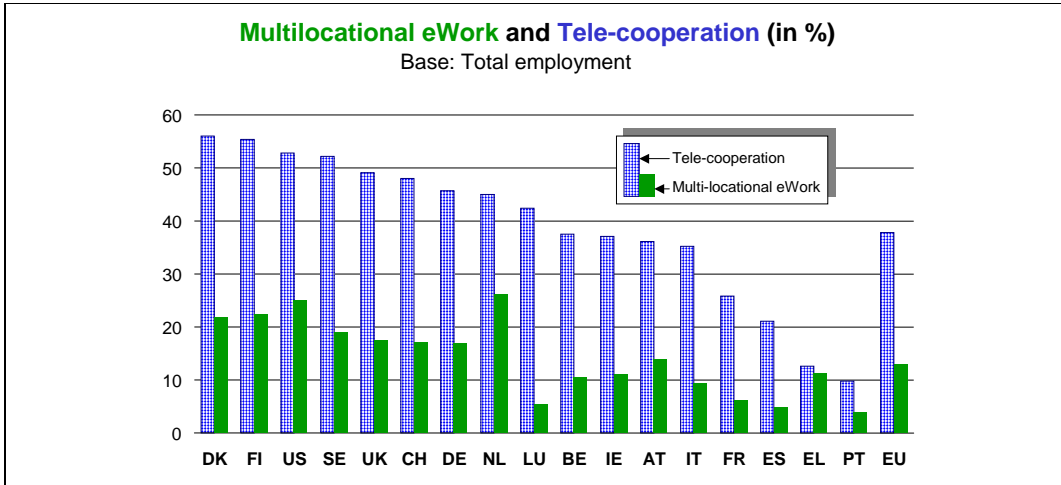
While these approaches open up various possibilities for producing statistics on multi-locational, ICT-supported work, it is restricted to remote work in the sense of working taking place “outside the traditional workplace” and remotely from the location of the employer. In contrast, what has been termed tele-cooperation (Gareis & Hüsing 2002) would not (necessarily) be covered by such definitions. Such tele-cooperation is conceptually closely related to telework, which is why it has been dubbed ‘in situ telework’: Although the majority of white-collar workers today appear to be co-located in central office buildings, in fact they are often working closely together with value chain and project partners at far away locations. Theory suggests that tele-cooperation can boost worker productivity and innovative performance throughout the EU economy by allowing flexible configurations of human capital without actually moving people from one place to the other.

One attempt to collect data on tele-cooperation was undertaken by the SIBIS project (Empirica 2002). It was operationalised for survey research as “communicating with external business contacts via e-mail, video-conferencing or electronic data transfer”. For further explanation, external persons were described as “customers, clients, suppliers, other business contacts, but also colleagues working at other locations of the same company”.

It becomes obvious from comparing the share of workers involved in tele-cooperation (as defined above) with the number of teleworkers (see Figure 10) that tele-mediated work practices are affecting many more people than only those who actually work from a remote place. It has often been observed that ICTs enable work to be brought to the worker (telework) instead of transporting workers to work (commuting). But work inputs and outputs are also increasingly transmitted between traditional workplaces via ICTs. This is a process

which involves all parts of the economy and, as the SIBIS pilot data show, already more than a third of the EU workforce.

Figure 8: Telework and Tele-cooperation in EU15 Countries in 2002 (in % of total employment)

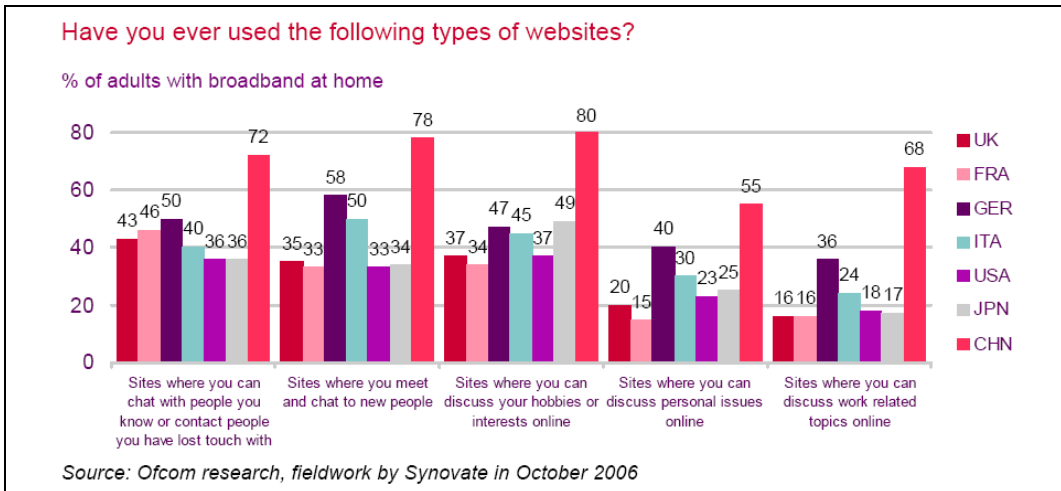


Source: Gareis (2006), based on data from SIBIS 2002/2003, see Empirica (2002)

In the future further steps will become necessary to gather data on the nature of tele-mediated cooperation. This is likely to require special surveys which analyse working processes in much detail. Existing surveys such as Germany's "Qualification and Employment Situation Survey" (BIBB/IAB) can act as bases for this.

Some statistics have started to appear on the use of Internet applications for social networking, see Figure 9. According to the survey conducted by OFCOM, the UK telecoms regulator, between 16% (UK, France), 36% (Germany) and 68% (China) of broadband users are using websites for discussing work-related topics.

Figure 9: Use of social networking sites on the Internet

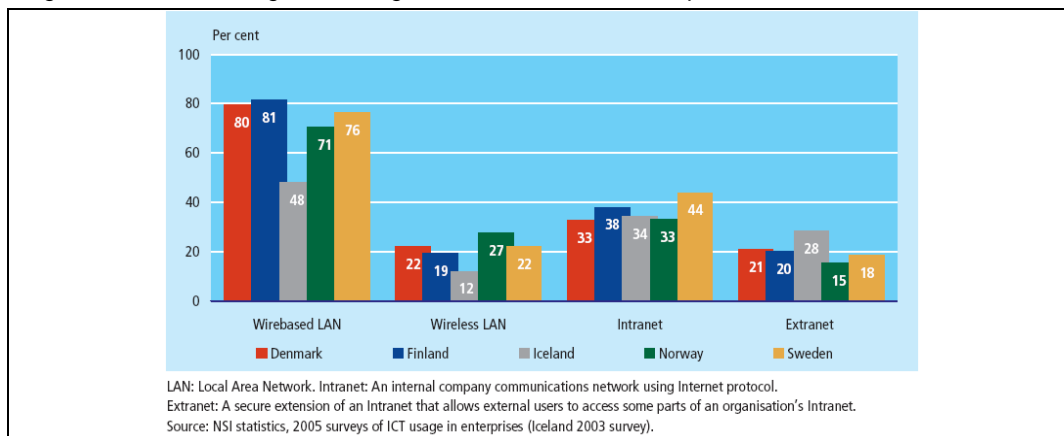


Source: OFCOM 2006

**Indicators on Co-operation and Collaboration at Organisational Level**

The data situation at the level of the firm/organisation is somewhat more favourable, due to the indicators provided by the National Statistical Institutes on the spread of particular networking technologies, the European Commission's eBusiness Watch survey, and the European Community Innovation Survey (ECIS). An example of the first of these is presented in Figure 10 below.

Figure 10: Networking technologies used in Nordic enterprises, 2005



Source: Nordic Council of Ministers 2005

The eBusiness Watch survey also collects data about the ability of employees to access the company computer network from outside (remote access, see Table 4).

Table 4: Internet access and remote access to company network in Europe

	Companies with internet access		Companies with broadband internet access		Share of employees with internet access *		Remote access to company network	
	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms
<b>Total (EU-10)</b>	<b>95</b>	<b>93</b>	<b>76</b>	<b>69</b>	<b>n.a.</b>	<b>43</b>	<b>35</b>	<b>16</b>
<b>By firm size</b>								
Micro (1-9 empl.)		89		62	n.a.	51		12
Small (10-49 empl.)		98		75	n.a.	29		22
Medium (50-249 empl.)		99		83	n.a.	33		43
Large (250+ empl.)		99		84	n.a.	44		60
<b>By sector</b>								
Food & beverages	95	88	72	64	n.a.	25	35	14
Footwear	96	89	75	62	n.a.	28	17	10
Pulp & paper	99	94	80	68	n.a.	40	56	21
ICT manufacturing	100	99	84	79	n.a.	74	69	35
Consumer electronics	98	97	87	74	n.a.	80	51	32
Shipbuilding & repair	100	100	87	86	n.a.	30	41	27
Construction	95	90	72	64	n.a.	47	25	13
Tourism	93	90	72	68	n.a.	53	38	13
Telecommunication	100	99	88	85	n.a.	90	74	46
Hospital activities	100	98	85	78	n.a.	41	39	34
Base (100%)	firms using computers		firms using computers		firms with internet access		firms using computers	
N (for total, EU-10)	7237		7237		6900		7237	
Questionnaire reference	A1		A3		A2		A5	

\* Read: "In the companies surveyed, on average, 43% of employees have access to the internet at their workplace."

Source: eBusiness Watch 2007

The ECIS covers firm-level collaboration which is being practised in the area of R&D or other activities related to innovation. The definition given in the (postal) questionnaire is:

“Innovation co-operation is active participation with other enterprises or non-commercial institutions on innovation activities. Both partners do not need to commercially benefit. Exclude pure contracting out of work with no active co-operation.”

A key indicator from the ECIS is the “percentage of all innovative firms that co-operate with other firms or organisations” (see Table 5). Distinctions are made between the type of cooperating partner:

- Other enterprises within your enterprise group;
- Suppliers of equipment, materials, components, or software;
- Clients or customers;
- Competitors or other enterprises in your sector;
- Consultants, commercial labs, or private R&D institutes;
- Universities or other higher education institutions;
- Government or public research institutes.

For each category, respondents are required to state its location (same country; other Europe, United States, all other countries; see Figure 11). The survey also asks for the type of co-operation partner which the respondent firm found most valuable for its innovation activities. The data on these indicators is collected only from “innovative firms”, which themselves are defined as those that “have introduced technologically new or improved products or services on the market, or technologically new or improved processes. The product should be new to the enterprise, but does not necessarily have to be new to the enterprise’s market”.

Table 5: Enterprises involved in innovation related co-operation

	Enterprises with innovation activity, % of all enterprises	All types of co-operation with other enterprises or institutions	Co-operation partners:			
			Suppliers	Clients or customers	Universities or other higher education institutes	Government or public research institutes
			% of all innovative enterprises			
EU27	42	26	17	14	9	6
Belgium	51	36	26	21	13	9
Bulgaria	16	22	16	13	6	4
Czech Republic*	38	38	31	26	13	7
Denmark	52	43	28	28	14	7
Germany	65	16	7	8	8	4
Estonia	49	35	23	23	9	6
Ireland	52	32	23	25	10	6
Greece	36	24	11	8	6	2
Spain	35	18	9	4	5	5
France	33	40	26	20	10	7
Italy	36	13	7	5	5	1
Cyprus	46	37	24	4	2	2
Latvia	18	39	33	29	14	12
Lithuania	29	56	45	35	12	10
Luxembourg	52	30	24	22	10	8
Hungary	21	37	26	20	14	5
Malta	21	32	22	17	4	4
Netherlands	34	39	30	22	12	9
Austria	53	17	7	8	10	5
Poland	28	42	28	16	6	9
Portugal	41	19	14	12	8	5
Romania	20	17	14	10	4	4
Slovenia	27	47	38	33	19	13
Slovakia	23	38	32	30	15	11
Finland	43	44	41	41	33	26
Sweden	50	43	32	28	17	6
United Kingdom	43	31	23	22	10	8
Iceland	52	29	20	20	5	13
Norway	37	33	23	22	15	16

\* Data for Czech Republic correspond to the reference period 2003 - 2005  
Source: fourth Community Innovation Survey

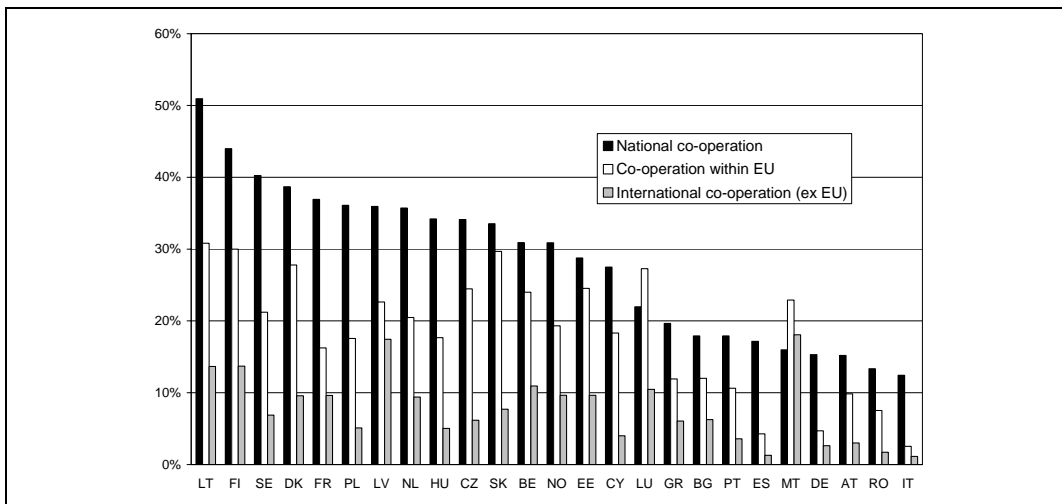
Source: Eurostat 2007

Additional ECIS indicators of interest include:

- Organisational change in enterprises – Share of enterprises that have changed their organisational structure in the reference period in any of the following ways: (a) New or significantly improved knowledge management systems to better use or exchange information, knowledge and skills within your enterprise; (b) A major change to the organisation of work within your enterprise, such as changes in the management structure or integrating different departments or activities; (c) New or significant changes in your relations with other firms or public institutions, such as through alliances, partnerships, outsourcing or sub-contracting.
- Outcomes of organisational change in enterprises: Degree of observed effect: high, medium, low, not relevant: (a) Reduced time to respond to customer or supplier needs; (b) Improved quality of your goods or services; (c) Reduced costs per unit output; (d) Improved employee satisfaction and/or reduced rates of employee turnover.
- Sources of information for launching new innovation projects or contributing to completion of existing projects: information sources within the enterprises; other enterprises within the enterprise group, suppliers, clients or customers, competitors and other enterprises from the same industry, universities or other higher education institutes, government or private non-profit research institutes, professional conferences, meetings, journals, fairs, exhibitions.

The drawback of the ECIS indicators is the focus on collaboration for innovation purposes, and the lack of data on the extent to which ICTs are used for collaboration purposes. Having said that, the ECIS should provide a very useful platform for integration of variables which are of direct relevance for the analysis of NWEs.

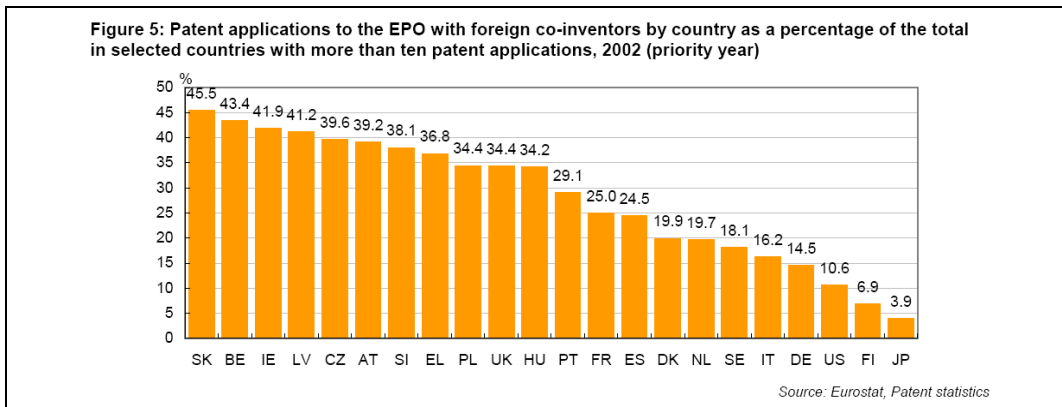
Figure 11: Enterprises engaged in co-operation, as percentage of all innovating enterprises (2002-4)



Data source: Eurostat

Other statistics which put the spotlight on collaboration within the context of R&D can be derived from the European Patent Office (EPO) data. For example, Figure 12 shows the share of all applications to the EPO which involve foreign co-inventors. It is particularly high in a number of smaller EU countries including Slovakia, Belgium, Ireland and Latvia. In each of these, the figure is about four times as large as in the USA, and nearly three times as large as in Germany.

Figure 12: Patent applications to the EPO with foreign co-inventors



Source: Eurostat (Frank 2006)

The extent, structure and shape of Information Society related collaborative networks in Europe has been researched by Malerba et al. (2007) using network topology analysis. The methodology comprised the following steps:

- Identification of locations (at NUTS2 level) of participants in IST research projects, operationalised as European networks formed by organisations participating in FP6 IST – TA1 projects;
- Identification of locations (at NUTS2 level) of participants in IST deployment projects defined as European networks formed by organisations participating in eTen and eContent projects;
- Calculation of “intensity of participation” indicators on both research and deployment for all NUTS2 regions in EU15;
- Collection of data on participation of NUTS2 regions in selected Community deployment initiatives such as LEADER+, INTERREG, EQUAL and URBAN as supplementary information.

The value of these indicators as proxies for the overall networking intensity of local firms and public-sector organisations in ICT-related R&D and deployment is dependent on the extent to which participation in EU research is representative of overall participation in these activities. Nevertheless, network analysis derived indicators appear to be of high potential value for the statistical analysis of inter-firm networking for collaboration on ICT research and deployment.

A recent edition of the European Commission’s annual Innobarometer enterprise survey dealt with the issue of localised collaboration within clusters, see bbox below.

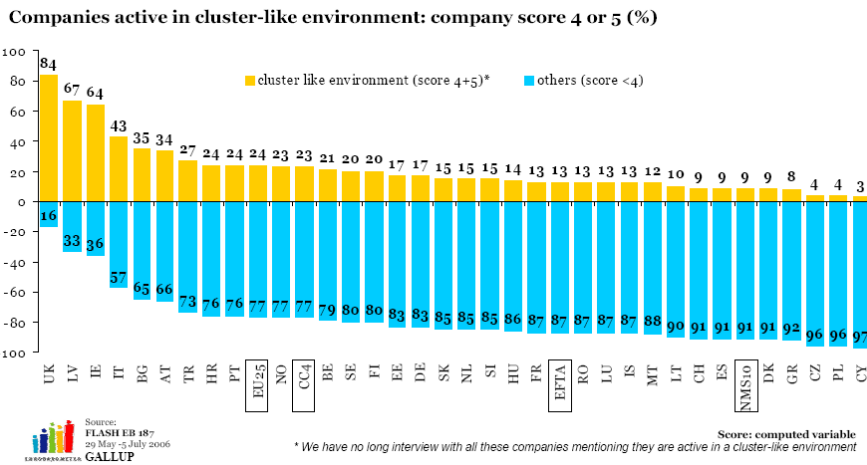
### INNOBAROMETER Indicators on Collaboration in Clusters

Innobarometer used a notion of “cluster-like environment”, operationalised as follows: five questions and a scoring system to each were applied in order to define cluster-like business environment for each respondent company. The questions used are (in parenthesis the answer that earned a point to the score of the respondent):

- Does your company (its local establishment) have significantly stronger linkages with suppliers and service providers that are geographically close than with others? (yes)
- In your region, does your firm have contacts with other firms, universities and administrative bodies to discuss common problems or potential shared opportunities? (yes, frequently)
- Is your firm located in a region where the concentration of firms working in the same business sector as yours is: (higher than elsewhere in the country)
- [Awareness of cluster-definition] (aware)

• Are there clusters active in your region, in your field of activity? (yes)

The maximum number of points was 5. The authors considered companies reaching at least 4 points as working in an environment that might be classified as cluster-like. As the chart below shows, the proportion of firms that classified as operating in a cluster is quite dramatically different across the countries of the European Union, and in a broader sense in Europe, too.

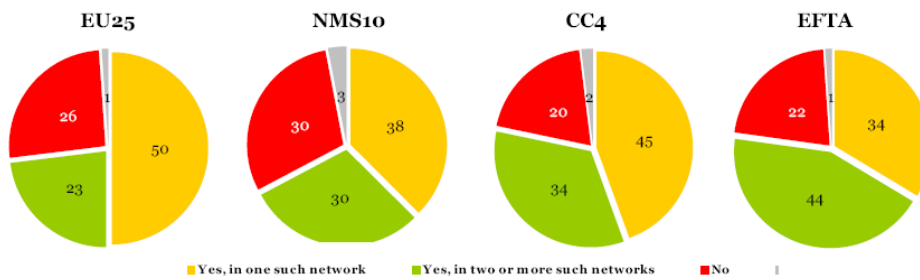


The findings are not always consistent with evidence from existing research, which may indicate that the methodology deployed to identify cluster-like environments was not fully adequate (at least in some countries).

Companies identified this way as being part of “cluster-like environments” were presented with a number of additional questions producing, among others, the following indicators:

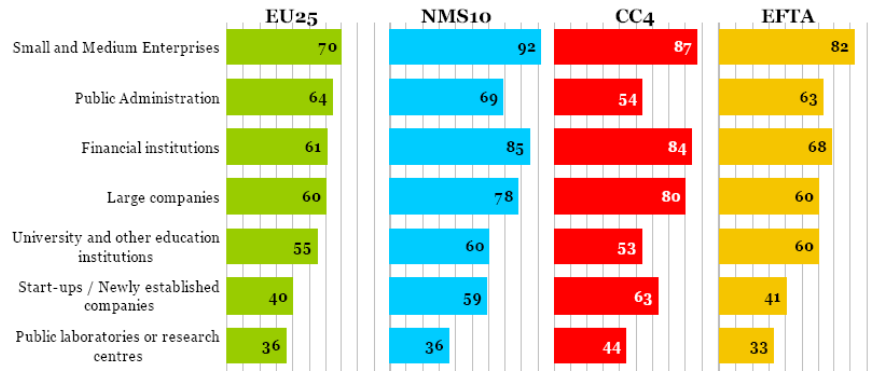
- Percentage of companies who have contacts with other firms, universities and administrative bodies to discuss common problems or potential shared opportunities
- Percentage of companies who actively participate in one or more networks containing local companies and or public administration involved in the same business sector.

Active participation in networks



- Percentage of companies who cooperate with one of a number of possible partners in the cluster (type of co-operator)

**Cluster-firms cooperate with:**



Source: FLASH EB 187  
29 May - 5 July 2006  
GALLUP

Q12. Do you cooperate with the following partners in the [CLUSTER / REGION]?  
% among companies active in cluster-like environment

- Partnership Diversity Index (average number of the partnerships mentioned)
- Main field for co-operation within cluster: Hiring of skilled people; Exchanging information on market; Stimulating the entrepreneurship spirit; Developing partnerships on specific business projects; Exchanging best practices; Exchanging information on technology; Facilitating access to finance; Facilitating sharing of infrastructures (e.g. buildings, research labs, training facilities); Access to research infrastructures (labs, universities, etc); Developing partnerships to compete on the European market; Shortening time to enter market; Facilitating access to land.

**Forms of cooperation within the cluster**  
(EU-25)



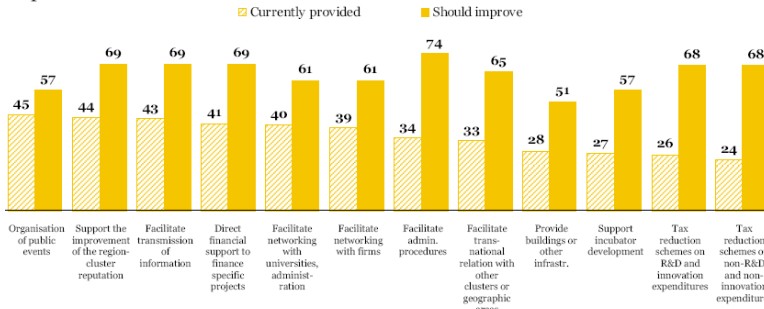
Source: FLASH EB 187  
9 May - 5 July 2006  
GALLUP

Q14a. Please, tell me for each of the following activities and areas if they are characteristic to your [CLUSTER / REGION]?  
% among companies active in cluster-like environment

- Percentage of companies who perceive the role of public authorities in supporting their clusters as important or fundamental.

- Types of support provided by public authorities for clusters – current perception and required improvements: Direct financial support to finance specific project; Facilitate administrative procedures; Provide buildings or other infrastructures; Tax reduction schemes on R&D and innovation expenditures; Tax reduction schemes on non-R&D and non-innovation expenditures; Organisation of public events (fairs, trade missions); Facilitate networking with universities, administration; Facilitate networking with firms; Support incubator development; Support the improvement of the region/cluster reputation; Facilitate transmission of information (market needs, market situation, new regulation); Facilitate transnational relation with other clusters or geographic areas

Support activities of public authorities: assessment of current levels and desire for improvement



Source: FLASH EB 187, 29 May - 5 July 2006  
EMERGENGE GALLUP

Q22. From the following list of instruments, please tell me which are the ones currently provided by public authorities to support your [CLUSTER / REGION]? (% "currently provided" shown)  
Q23. In your opinion, in which areas should public authorities improve their activities to better support your [CLUSTER / REGION]'s development? (% "should improve" shown) among companies active in cluster-like environment

- Percent of the companies who perceive that being part of a cluster give them an advantage to compete on the local/ regional/ national/ European/ world market
- Percent of the companies perceiving the membership in a cluster as highly beneficial or somewhat beneficial for one of the following departments: Research & Development; Marketing; Sales; Production; Human resources; Procurement / acquisition / supply
- Percent of the companies who perceive that being in a cluster facilitated the extension of the scope of the activities of the company
- Percent of the companies who state that being in the cluster was a significant driver in locating the firm at the current location

Source: EOS Gallup 2006

A detailed set of indicators on ICT-enabled cooperation was piloted in the context of the EMERGENGE project (Huws & O'Regan 2001), which focussed on formalised collaboration along the value chain (see box below). EMERGENGE made use of a telephone survey, with the unit of observation being establishments with >50 employees located in the EU15 (plus CZ, HU, PL). The study found that about 43% of all establishments made use of "e-outsourcing" in the year 2000, and 5% did so with partner companies in foreign countries.

### EMERGENGE eWork Indicators

The project defined seven generic business functions which were deemed to be "delocalisable" (i.e. feasible for ICT-enabled delocalisation). These were:

- Sales (telemarketing and mobile sales)
- Customer service (e.g. providing information, counselling & advice to customers)
- Data processing (e.g. typing and other forms of data input)

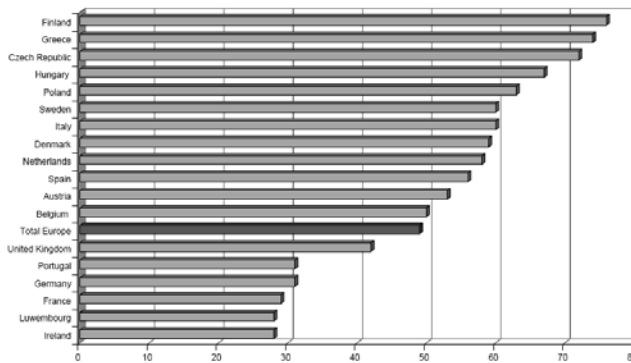
- Creative or content-generating work (e.g. R&D, design, editorial work, multimedia production)
- Software development, maintenance and support
- Accounting, debt collection and other financial services
- General management, human resources management, and training.

For each of these business functions, the survey asked whether it was carried out (a) remotely, i.e. it took place at a geographical distance from the establishment which was surveyed; and (b) by means of telemediation, i.e. that a telecommunications link was used to deliver the work. In the latter case, a distinction was made between:

- fully home-based working by employees (telework)
- multi-locational or nomadic working by employees
- freelance work carried out away from the premises
- remote work carried out in internally owned back offices excluding/including call centres
- remote work carried out in third-party premises excluding/including call centres
- work outsourced to business service suppliers excluding/including call centres.

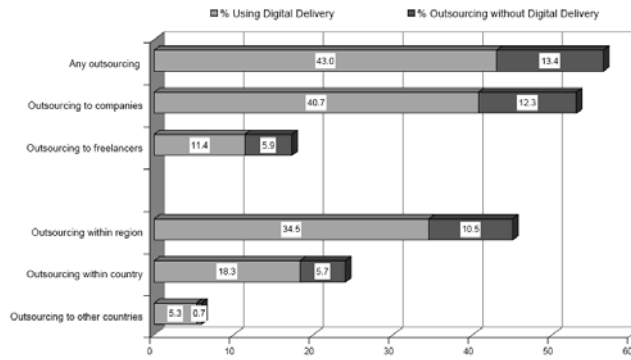
When combined with the seven categories of generic services, these nine possible forms result in 63 different possible forms of eWork which may be used (at least in theory) by any given organisation.

Figure 3. Distance electronically mediated work by country (demand side), 2000  
(Percentage of establishments with >50 employees using)



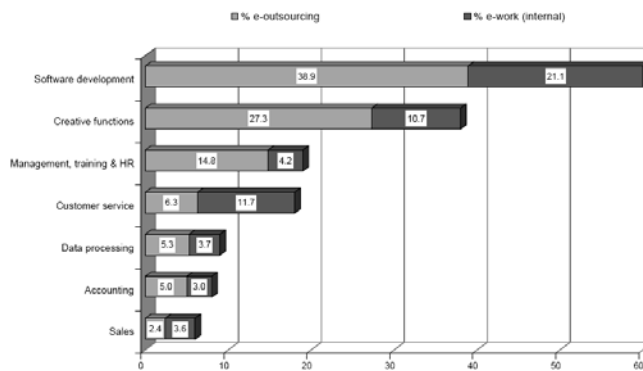
Source: Derived from Huws, U. & O'Regan, S. (2001) *E-work in Europe: Results from the 18-Country Employer Survey*, Institute for Employment Studies, IES Report 380, p18.

Figure 4. Outsourcing and digital delivery in Europe (demand side), 2000  
(Percentage of establishments with > 50 employees)



Source: Derived from Huws, U. & O'Regan, S. (2001) *E-work in Europe: Results from the 18-Country Employer Survey*, Institute for Employment Studies, IES Report 380.

Figure 5. Outsourcing and digital delivery in Europe by function (demand side), 2000  
(Percentage of establishments with > 50 employees)



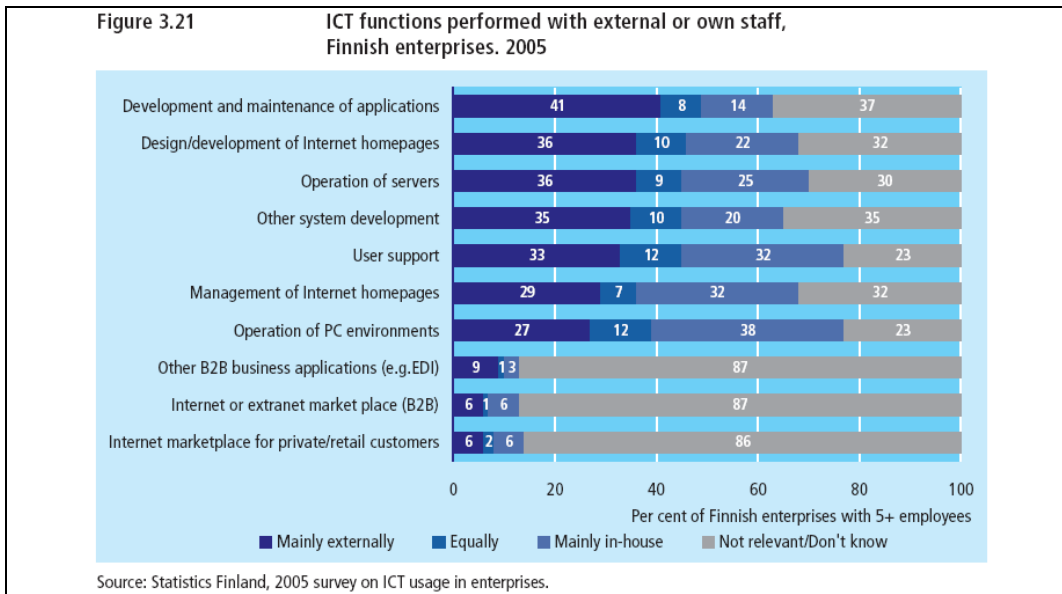
Source: Huws, U. & O'Regan, S. (2001) *E-work in Europe: Results from the 18-Country Employer Survey*, Institute for Employment Studies, IES Report 380.

Source: Huws (2002: 4-6); Figures: OECD (2004)

It appears that making a distinction between “**electronic outsourcing**” and outsourcing in general is quickly becoming irrelevant. Already in 2001, the EMERGENCE survey found that 88% of establishments that outsourced business activities to a foreign supplier used an electronic connection for delivery<sup>2</sup>. We can assume, therefore, that some degree of electronic collaboration between supplier and customer takes place in nearly all current cases of cross-border outsourcing. The disadvantage of the EMERGENCE indicators is their high degree of complexity, which makes them extremely difficult to integrate in existing data collection frameworks.

<sup>2</sup> The equivalent figure for establishments that outsourced to domestically was 76%.

Figure 13: ICT functions affected by ICT outsourcing in Finland



Source: Nordic Council of Ministers 2005

A large number of surveys have covered the subject of outsourcing and off-shoring, as these have been intensively discussed by the public in recent years. Most available statistics concern outsourcing of ICT functions and services, as the example from Finland depicted in Figure 13.

The European Commission's eBusiness Watch has indicators on the tools used for inter-organisational collaboration, see Table 6.

Table 6: Online cooperation and collaboration within the value system

	Share documents in collaborative work space		Manage capacity / inventory online		Collaborative design processes		Collaborative forecasting of demand	
	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms	% of empl.	% of firms
<b>Total (EU-10)</b>	<b>27</b>	<b>14</b>	<b>22</b>	<b>10</b>	<b>15</b>	<b>7</b>	<b>20</b>	<b>11</b>
<b>By firm size</b>								
Micro (1-9 empl.)		10		8		5		10
Small (10-49 empl.)		19		14		8		13
Medium (50-249 empl.)		31		21		13		19
Large (250+ empl.)		47		41		25		41
<b>By sector</b>								
Food & beverages	28	10	24	11	15	6	23	10
Footwear	18	12	17	9	11	10	11	11
Pulp & paper	27	17	32	13	16	11	19	12
ICT manufacturing	45	26	37	16	27	15	26	16
Consumer electronics	45	22	29	12	20	18	17	19
Shipbuilding & repair	27	19	19	15	20	7	16	11
Construction	22	9	14	8	9	5	14	8
Tourism	26	12	25	8	21	8	30	15
Telecommunication	51	36	29	19	27	19	29	23
Hospital activities	37	33	34	25	11	8	n.a.	n.a.
Base (100%)	firms with internet access	firms with internet access	firms with internet access	firms with internet access	firms with internet access	firms with internet access	firms with internet access (without hospitals)	
N (for total, EU-10)	7008	7008	7008	7008	7008	6475		
Questionnaire reference	D5a	D5e	D5d	D5c				

Source: eBusiness Watch 2007

eBusiness Watch defined key terms related to e-business as follows:

- e-Transactions: Commercial exchanges between a company and its suppliers or customers which are conducted electronically. Participants can be other companies ("B2B" – business-to-business), consumers ("B2C"), or governments ("B2G"). This includes processes during the pre-sale or pre-purchase phase, the sale or purchase phase, and the after-sale / purchase phase;
- e-Commerce: Electronic Commerce. The sale or purchase of goods or services, whether between businesses, households, individuals, governments, and other public or private organisations, conducted over computer-mediated networks (definition originally from OECD);
- e-Business: Electronic Business. Automated business processes (both intra- and inter-firm) over computer mediated networks (definition originally from OECD);
- e-Interactions: Electronic Interactions include the full range of e-Transactions, and in addition collaborative business processes (e.g. collaborative design) which are not directly transaction focused.

Of most interest to the present study are inter-firm e-business applications (as well as those which bind together firms with organisations from the public sector, such as educational organisations). Unfortunately, a well-established conceptual model for e-business and its measurement is not yet available. However, the OECD Model Questionnaire of ICT Use by Businesses (OECD 2005b: 104-129) has questions on linkages associated with e-commerce, whether "systems used to receive/place orders over computer networks are linked with internal systems, customers' systems and/or suppliers' systems. There is an emphasis on e-commerce linkages because of the significant interest still in e-commerce and the potential productivity gains from automatically linking electronic transactions with downstream processes such as inventory ordering, delivery, accounting functions etc. In addition, questions such as these are fairly well-defined in a statistical sense and have been used (though not necessarily in the exact form as on the model questionnaire) reasonably successfully by at least two member countries (the United Kingdom and Australia)" (OECD 2005: 45). The OECD also discussed whether it is possible to collect valid data on "integrated e-business processes", such as supply-chain management (SCM) and CRM (customer relationship management), see box below.

#### **Options for Measurement of Integrated e-Business Processes**

There are several possible approaches which could be considered in measuring the use of integrated e-business processes. They include:

(a) Directly ask the business whether it uses applications such as SCM (supply chain management), ERP (enterprise resource planning) or CRM (customer relationship management). Following the arguments presented above, the best statistical approach is probably to describe those processes rather than to use the precise terms and expect that respondents will understand them in the same way. Denmark used a descriptive approach in its 2005 survey to ask about use of ERP and CRM applications. However, it is considering changing that approach to ask about processes rather than systems. This is because it is thought that respondents might not uniformly understand terms which describe specific systems (as ICT systems could integrate several processes).

(b) Follow the Statistics Canada approach to asking about integrated business processes. The questions tested by Canada<sup>42</sup> were: whether a browser-based system is used to manage functions associated with online sales, online purchases, customer relations and logistics. Supplementary questions asked about automatic linkages with backend systems, customers' systems and suppliers' systems.

(c) Ask about sales and purchases transactions generally and whether those transactions generate an automatic update in other systems such as backend systems, customers'

systems and suppliers' systems. This approach has the advantage that it covers all sales and purchase transactions not just those which constitute e-commerce. It also focuses on functions which are common to most businesses (that is, purchasing and selling goods or services).

(d) Consider Denmark's approach (used in its 2005 survey) for obtaining information on external integration. Denmark asked about the electronic exchange of data between the business' systems and other entities' systems. It specified that these exchanges use structured messages and agreed message standards. More information is provided in the form of a classification of the types of documents and transactions for which data are exchanged (they include salary transactions, electronic invoicing, product descriptions, transport documents, data for public authorities and financial transactions).

All these approaches present a problem which also occurs in other areas of ICT use measurement and that is 'how can the significance of the activity be ascertained'? It would almost certainly be problematic to ask businesses about the number of 'linked transactions', their value or other measures of intensity. Therefore the data obtained from approaches such as those described above are generally a series of 'yes/no' responses. This means that if a business is using particular e-business processes for a minor part of its business or in respect of a small number of transactions, its reply has the same significance as a business which has used ICT to completely transform the way it does all its business.

*Source: OECD 2005b: 45-46.*

In spite of these challenges, some indicators on the use of inter-firm collaboration tools and structures are available from the eBusinessW@tch as well as from other sources. The UNDERSTAND dataset, for example, includes indicators on business use of a) customer relationship management systems, b) supply chain management systems, c) collaboration with business partners to forecast product demand, to manage capacity or inventories, d) telephone conferencing, e) video conferencing, f) online discussion fora, g) Internet relay chat. Eurostat's ICT Usage Enterprise Survey asks whether the respondent firms have IT systems for managing orders which automatically link with any of the following IT systems: a) Internal system for re-ordering replacement supplies, b) Invoicing and payment systems, c) Your system for managing production, logistics or service operations, d) Your suppliers' business systems (for suppliers outside your enterprise group), e) Your customers' business systems (for customers outside your enterprise group).

An aspect of ICT-based collaboration which has come into the focus of statistical measurement recently is ICT outsourcing. The UNDERSTAND firm survey asks companies whether they have outsourced ICT services to an external service provider in any of a number of application areas (maintenance of hardware and/r network; web hosting or data storage services; software development; software application hosting to application service provider; call centre services; other ICT services). This topic is also being covered in the e-skills module that has been included in the 2007 edition of the Eurostat ICT Usage Enterprise Survey . It asks:

- Whether any ICT functions (i.e. those requiring ICT practitioners) are performed by external suppliers, either in the same country, abroad but within the EU, or in non-EU countries;
- Whether any ICT functions are performed by foreign affiliates which were established by the enterprise (internal suppliers from abroad), and if so, which functions these are (ICT management; ICT development and implementation; ICT operations; other);
- Whether any business functions that require ICT user skills or e-business skills are performed by external suppliers, either in the same country or abroad;
- Whether any business functions that require ICT user skills or e-business skills are performed by foreign affiliates which were established by the enterprise (internal suppliers from abroad), and if so, which functions these are (sales and marketing, customer services; research and development, product design and engineering; other).

There are also a number of national business surveys as well as surveys on work environments which have applied innovative indicators about inter-firm collaboration using ICT<sup>3</sup>.

With regard to the **regulative social processes** discussed in section 0, only very few studies have already looked into this issues in a quantitative manner. An exception is the ESCR / Cardiff University UK Small Firm Performance Survey piloted a number of indicators on collaborative relationships, community memberships and other "soft factors" which may be of importance for decision-makers in firms (Cooke & Clifton 2002). This included:

- Perceived importance of "hard" locational factors as well as "soft" factors (social contacts, membership of clubs, forums or societies) to the overall performance of your company;
- Geographical reach of social contacts and membership of clubs, forums or societies (local, regional, UK-wide, international);
- Perceived importance of informal information exchange with customers and suppliers;
- Number and type of collaboration partnerships, and their respective importance for business performance;
- Trust towards collaborators and its importance in "compensating for certain asset short-falls within your company";
- Perceived importance of different types of collaborative relationships (informal business & social relationships; contractual; arms-length; indirect (via a third party) relationships);
- Perceived importance of different modes of interaction (face-to-face; telephone/fax/video-based; IT based contact);
- Extent to which new social or business/social relationships are developed strategically.

On the basis of the data they collected, Cooke et al. (2005: 1073) suggest that there are "so many factors (both endogenous and exogenous) impacting simultaneously, any given individual variable is typically only associated with very small variances in another [including performance indicators]". For this reason, they recommend data reduction analysis to create composite variables, as these are likely to be more effective in showing associations.

Westlund and Nilsson (2005) piloted a number of indicators for the measurement of investments in social capital by enterprises. They included monetary investments in internal social capital (formal education, internal entertainment) and in external social capital (R&D, marketing, local sponsorship, external entertainment) as well as investments in time in internal social capital (formal education, internal entertainment) and in external social capital (social contacts with decision-makers, external entertainment). The authors concluded from their research that "only direct investment in social links can give a correct picture of social capital" (ibid.: 1092), as social links do not logically and consistently emerge as a by-product of investments in economic links. Westlund and Nilsson follow that "measuring the investments made by enterprises in social capital requires the use of questionnaires, with all the problems associated with this method" (ibid.).

### *Society-Level Indicators on Globalisation*

We want to disregard strictly macro-economic indicators of international division of labour, such as FDI or trade balances which describe the international integration of whole economies. These topics have been covered extensively in a number of OECD publications, including the "Handbook on Economic Globalisation Indicators" (OECD 2005c) and the report "Measuring Globalisation: Activities of Multinationals" (OECD 2007).

We will also not report on multi-dimensional indices such as A.T. Kearney' "Global Top 10"<sup>4</sup>. These indices rank countries according to a compound indicator made up from existing national statistics, thereby arriving at some sort of aggregate index on globalisation.

<sup>3</sup> see STILE Questionnaire Database at [www.stile.be/surveydb/](http://www.stile.be/surveydb/)

Instead we focus on firm level indicators that describe a firm's exposure to globalisation. The term exposure to globalisation as far as it is a characteristic firms shall be used interchangeably with international integration. International integration of firms can be defined in many terms: foreign ownership or the weight of foreign owned shares, having affiliates or branch offices abroad, the number of employees foreign (and especially the extent to which expatriates are sent to and from international branch divisions), the shareholder investment in foreign companies, the extent to which supplier relations or, more generally, value chains are international, or the return from export business.

In the public perception, **outsourcing and offshoring** are getting a lot of attention, and are often associated with potential job losses. Hovlin (2006) makes a useful distinction of relocation of production according to location and control. She defines the two boxes on the right hand side of the exhibit below as "offshoring", and the two upper boxes as outsourcing (see Table 7).

Table 7: Types of outsourcing

		Location	
		National	International
Control	Outside organisation	Outsourcing of production to external national supplier = <u>Onshore Outsourcing</u>	Outsourcing of production to external international supplier = <u>Offshore Outsourcing</u>
	Within organisation	National relocation of production within own organisation = <u>Insourcing</u>	International relocation of production within own organisation = <u>Captive Offshoring</u>

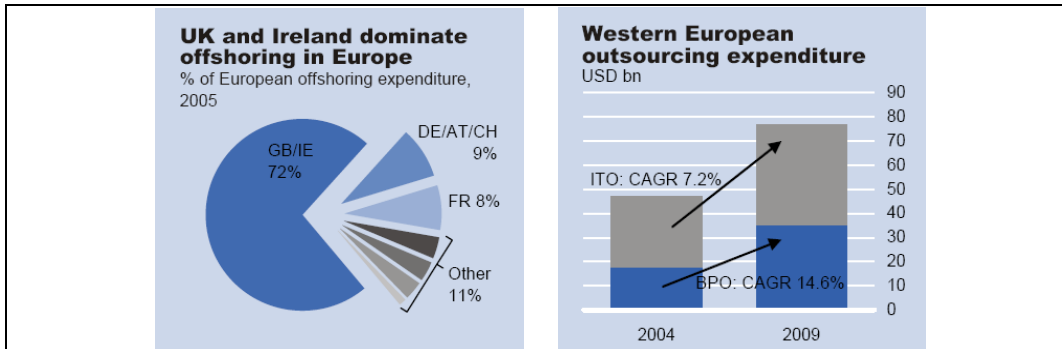
Source: Hovlin (2006), Mayer (2006)

The lower right box refers to domestic enterprises with subsidiaries abroad and information about it could be statistically gathered by looking at these enterprises and their production, employment, etc. abroad. The upper right box refers to international trade in intermediary services or goods. However, it is not evident when looking at trade statistics or firms' international branches that the activities stem from job relocation. Nevertheless, for the measurement of the extent of international integration of firms, which we are dealing with here, this questions appears to have little relevance.

Macro-level indicators which shed some light on the topic of offshoring can be derived from trade statistics. Other statistics which are quoted extensively stem from proprietary sources such as those provided by ICT consultancies including Forrester and IDC (see Figure 14). These are typically "educated guesses" based on a large variety of primary data and "expert judgement".

<sup>4</sup> [http://www.atkearney.com/shared\\_res/pdf/Globalization-Index\\_FP\\_Nov-Dec-06\\_S.pdf](http://www.atkearney.com/shared_res/pdf/Globalization-Index_FP_Nov-Dec-06_S.pdf)

Figure 14: Estimates of offshoring expenditure

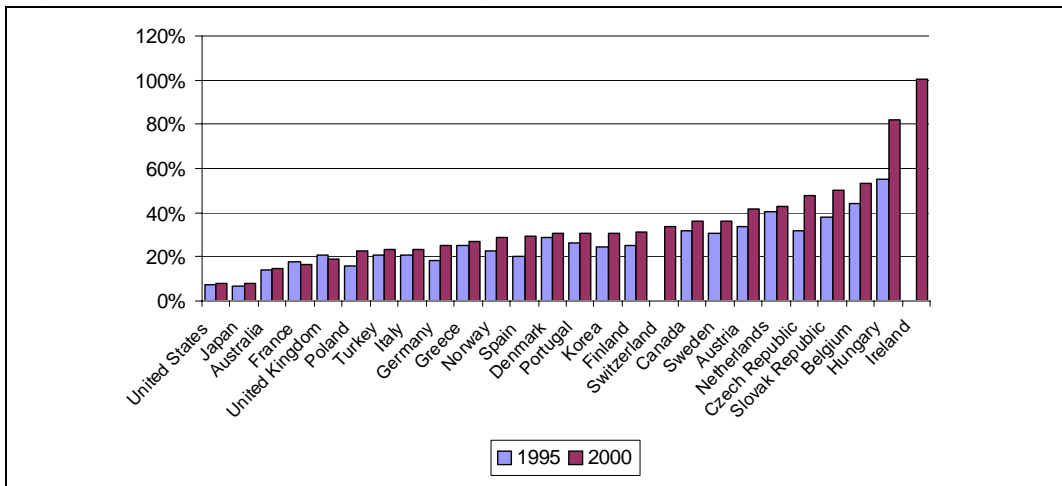


Source: Forrester Research Inc (2004) and IDC (2006), quoted in: Mayer(2006)

The OECD in their framework of globalisation indicators suggests several dimensions, which are:

- A. International Trade and Investment Flows
- B. Foreign Direct Investment
- C. The Activity of Multinationals in the Manufacturing Sector
- D. The Activity of Multinationals in the Services Sector
- E. Comparison between the Activity of Foreign Affiliates in Manufacturing and Service Sectors
- F. Contribution of Multinationals to Value Added and Labour Productivity
- G. The Internationalisation of Industrial R&D
- H. the International Diffusion of Technology
- I. Trends in International Trade in Goods and Services
- J. Intra-Firm Trade of Multinational Enterprises

Figure 15: OECD indicator on offshoring of intermediates

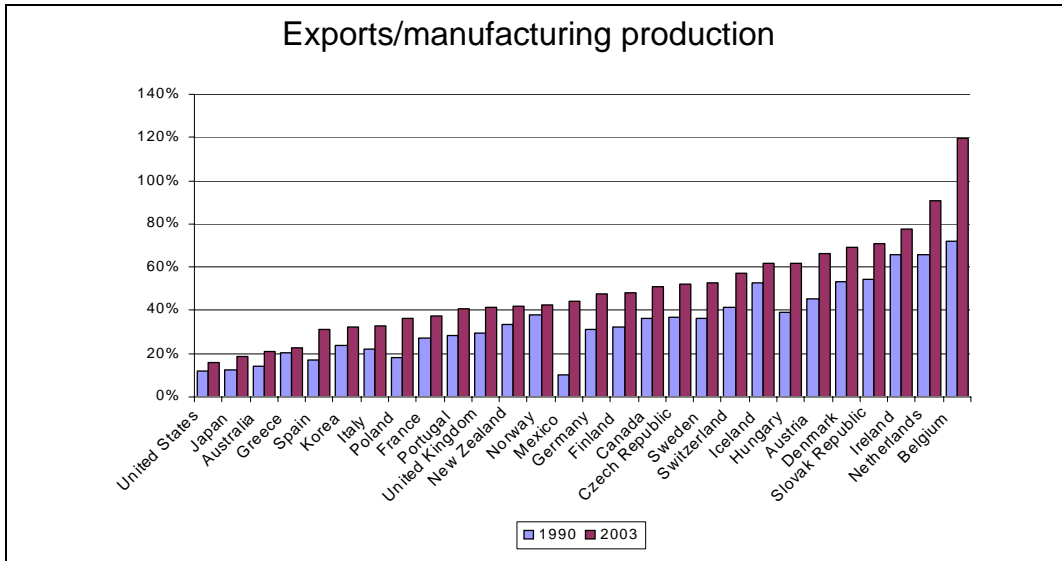


Source: De Backer (2006)

Some of the indicators used are for instance the ratio of "imported intermediate use/domestic intermediates use" which has grown in the majority of countries as is displayed in Figure 15.

Another OECD indicator is the share of exports in production, which has grown substantially. Exports are increasing much stronger than production (see Figure 16).

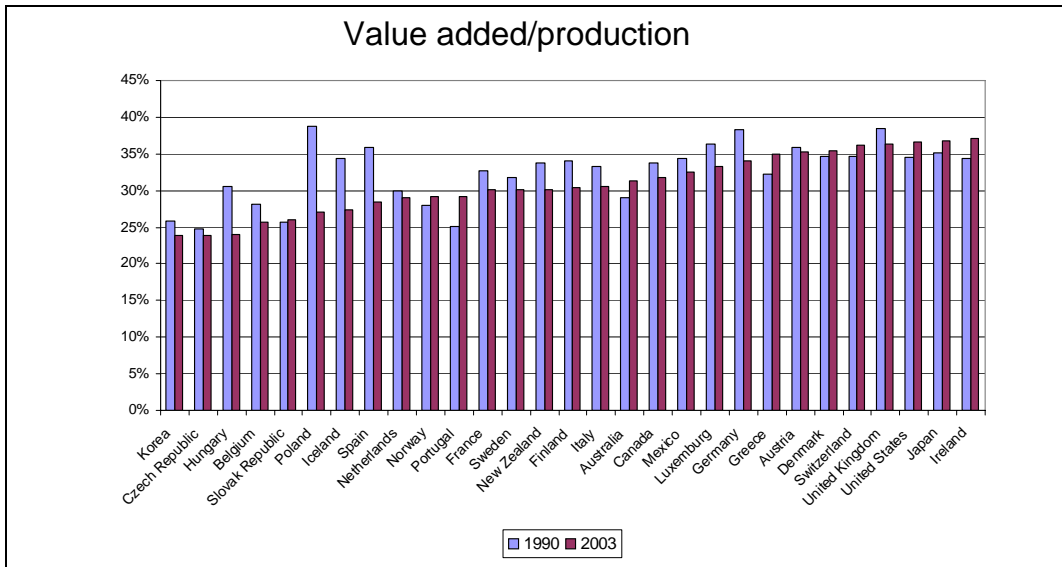
Figure 16: OECD indicator on exports as share of manufacturing production



Source: De Backer (2006)

Production depth, measures as value added in relation to production, is decreasing in most OECD countries (Figure 17), which implies the increasing importance of intermediate goods in production and the growing inter-connectedness of national economies across the world.

Figure 17: OECD indicator on production depth



Source: De Backer (2006)

Multi-national enterprises (MNEs) are considered as the main vehicle behind the process of economic globalisation. The OECD list of globalisation indicators includes therefore a large number of measures on the cross-border activities of MNEs, see box below.

**OECD<sup>5</sup> Proposed indicators for measuring the extent of globalisation related to MNEs**

**1. Reference indicators**

Extent of foreign control in the compiling country (total and by industry)

- Foreign-CAs' (foreign-controlled affiliates) share of value added.
- Foreign-CAs' share of turnover (sales) or gross production.
- Foreign-CAs' share of gross fixed capital formation.
- Foreign-CAs' share of employment.
- Foreign-CAs' share of compensation of employees.
- Foreign-CAs' share of the number of (consolidated) enterprises.

Extent of parent companies' activities in the compiling country (total and by industry)

- Parent companies' share of value added.
- Parent companies' share of turnover (sales).
- Parent companies' share of gross fixed capital formation.
- Parent companies' share of employment.
- Parent companies' share of compensation of employees.

Extent of MNEs' activities in the compiling country (total)

- MNEs' share of value added.
- MNEs' share of gross fixed capital formation.
- MNEs' share of employment.
- MNEs' share of compensation of employees.
- MNEs' share of number of consolidated enterprises.

**2. Supplemental indicators**

a) Outward activities of compiling country

Extent of CAs' activities abroad (total and by industry)

- CAs' abroad share of employment in the total of parent companies in the compiling country and their CAs abroad.
- CAs' abroad share of turnover done by parent companies in the compiling country and their CAs abroad.

Degree of geographical diversification of CAs' activities abroad (total and by industry)

- Herfindahl index of employment.
- Herfindahl index of sales or turnover.

b) Inward activities of compiling country

Extent of foreign control in the compiling country (total and by industry)

Foreign CAs' and parents' share of:

- Gross operating surplus.
- Taxes on income.
- Assets (financial and non-financial).

Degree of geographic diversification of foreign control (total and by industry)

- Herfindahl index of value added.
- Herfindahl index of sales or turnover.
- Herfindahl index of employment.

<sup>5</sup> Copied from OECD (2005c). Details as well as a variable list can be found in the publication.

Indicators of a very different kind have been collected on **people's attitudes** towards the topic of globalisation. As part of its opinion research, the European Commission has used Eurobarometer surveys to shed light on the overall situation and on national differences in this respect (EOS Gallup 2003). The findings need to be treated with care as intercultural comparative research of this kind is often subject to validity problems. Some results are presented in the tables below.

Table 8: Attitudes towards globalisation in the EU (I)

Q2. Globalisation is the general opening-up of all economies, which leads to the creation of a truly world-wide market. Are you personally totally in favour, rather in favour, rather opposed or totally opposed to the development of globalisation ?								
	BASE	Tout à fait favorable / Totally in favour	Plutôt favorable / Rather in favour	Plutôt opposé / Rather opposed	Tout à fait opposé / Totally opposed	[NSP&SR] / [DK&NA]	Favorable / In favour	Opposé / Opposed
EU 15	7515	13%	51%	20%	8%	8%	63%	29%
BELGIQUE	498	12%	52%	19%	7%	10%	64%	27%
DANMARK	501	14%	46%	19%	7%	14%	60%	26%
DEUTSCHLAND	501	8%	62%	20%	8%	2%	71%	27%
ELLAS	500	12%	36%	31%	20%	2%	47%	51%
ESPANA	503	12%	39%	21%	9%	20%	51%	30%
FRANCE	500	10%	53%	23%	10%	4%	63%	33%
IRELAND	500	20%	51%	17%	5%	7%	71%	22%
ITALIA	501	16%	52%	21%	7%	4%	67%	28%
LUXEMBOURG	503	18%	48%	25%	5%	5%	66%	29%
NEDERLAND	500	24%	54%	11%	5%	5%	78%	17%
OSTERREICH	500	7%	45%	29%	11%	9%	52%	40%
PORTUGAL	500	19%	44%	12%	4%	22%	63%	15%
FINLAND	501	10%	56%	22%	4%	7%	66%	26%
SWEDEN	500	18%	40%	18%	8%	16%	58%	26%
UNITED KINGDOM	507	17%	43%	18%	9%	14%	60%	27%

Q8. In your opinion, if globalisation intensifies in the future, would you say that overall this would be more or less advantageous for you and your family ?					
	BASE	Plus avantageux / More advantageous	Moins avantageux / Less advantageous	[Ni plus, ni moins avantageux] / [Neither more or less advantageous]	[NSP&SR] / [DK&NA]
EU 15	7515	52%	32%	10%	5%
BELGIQUE	498	43%	44%	7%	6%
DANMARK	501	49%	28%	13%	10%
DEUTSCHLAND	501	60%	34%	4%	3%
ELLAS	500	33%	46%	20%	1%
ESPANA	503	51%	26%	12%	12%
FRANCE	500	43%	47%	6%	3%
IRELAND	500	66%	23%	7%	3%
ITALIA	501	48%	25%	23%	5%
LUXEMBOURG	503	47%	34%	13%	6%
NEDERLAND	500	55%	32%	6%	7%
OSTERREICH	500	34%	34%	26%	6%
PORTUGAL	500	63%	17%	9%	11%
FINLAND	501	46%	31%	19%	4%
SWEDEN	500	49%	21%	17%	14%
UNITED KINGDOM	507	61%	29%	6%	4%

Source: EOS Gallup (2003)

Table 9: Attitudes towards globalisation in the EU (II)

Q6. Of the following two propositions, which is the one which is closest to your opinion with regard to globalisation ? Globalisation represents a good opportunity for [NATIONALITY] companies thanks to the opening-up of markets / Globalisation represents a threat to employment and companies in our country				
	BASE	La mondialisation constitue une bonne opportunit�... / Globalisation represents a good opportunity ....	La mondialisation constitue une menace ... Globalisation represents a threat ....	[NSP&SR] / [DK&NA]
EU 15	7515	56%	39%	5%
BELGIQUE	498	45%	53%	3%
DANMARK	501	64%	30%	6%
DEUTSCHLAND	501	61%	35%	5%
ELLAS	500	40%	58%	2%
ESPANA	503	56%	35%	9%
FRANCE	500	40%	58%	3%
IRELAND	500	63%	33%	4%
ITALIA	501	63%	32%	5%
LUXEMBOURG	503	53%	43%	5%
NEDERLAND	500	63%	35%	2%
OSTERREICH	500	50%	41%	9%
PORTUGAL	500	55%	39%	7%
FINLAND	501	60%	34%	6%
SWEDEN	500	65%	24%	11%
UNITED KINGDOM	507	61%	35%	5%

Source: EOS Gallup (2003)

## 2.4 The Main Gaps in Available Indicators

In general, collaboration using ICTs is a subject which has scarcely found any attention in existing surveys. This may be understandable given the elusiveness of the phenomenon, which makes it hard to measure using survey research. It does, however, seem very problematic in the face of evidence which suggests that collaboration across firms and other organisations is a prime determinant of competitiveness in the knowledge economy. It is clear that for Europe to develop its economic competitiveness while preserving current standards of wealth, social stability and equality, European companies have to make best use of virtual collaboration. It is also clear that NWEs, especially if stretching across the globe, pose significant challenges which may necessitate policy intervention. This applies, in particular, to the policy challenge of enabling and convincing more SMEs to take up virtual collaboration, and get involved in global collaboration networks.

There is therefore a need to provide better, more suitable and relevant statistical indicators for informing policy making at the EU, national and regional level in Europe. Because of the costs of data collection for producing statistics, any attempt to provide new indicators must put much focus on finding the most cost-effective means to collect the required data. There is also the issue of a potential conflict between the interests of data users at the national and the EU level, which means that the opportunities to obtain economies of scale by setting up European-wide data collection frameworks remain limited.

Against this background, the research in NewGlobal points out a number of key gaps in indicators availability, the filling of which should enjoy priority in the near future.

- **Inter-company collaboration:** There is very little comparative data on extend and types of collaboration, apart from the data from the Community Innovation Survey which focuses on collaboration in the context of formal innovation activities. The geographical spread of collaboration, and the reasons for the emergence of geographical patterns of collaboration, require more attention. From the viewpoint of policy directed at SME competitiveness, indicators on drivers and barriers affecting SMEs that consider or attempt to engage in global collaboration should be developed. Information on trends regarding collaborative activity are all but absent.

- **Collaboration between companies and public/civic sector institutions:** The key role of the state and the educational and civic sector in influencing collaborative activities of firms has been a major theme in research in recent years (e.g. see MacKinnon et al. 2002; Cooke 2002). Data on the extent to which SMEs collaborate with public and civic sector institutions have been collected rarely, though, and only in the context of one-off studies. The need for stronger interaction between firms and the education sector (e.g. universities) appears to be of particular importance, and should be reflected in statistical indicators.
- **Tools for collaboration:** There are hardly any indicators available at all on this subject, apart from industry (proprietary) data which are often hampered by low transparency of methodology and issues surrounding conflicts of interest. In recent years, the European Commission's eBusinessW@tch has made some progress in covering the topic. Further progress in this direction is necessary, for instance with regard to shortcomings and benefits of available ICT tools, specific issues which arise from use of these tools for collaboration across markedly different global cultures.
- **Specific issues of collaboration at global level:** Existing indicators in this area tend to focus on offshoring and other forms of job relocation. There is little data on the characteristics of global collaboration which is not based on service contracts or other forms or formal co-operation agreements. Particular attention should be given to soft factors (such as culture, language, attitudes) as contingencies explaining the success or failure of different types of collaboration.
- **Effects of global collaboration on outcomes:** Policy makers need better indicators which can be used for demonstration of the benefits which SMEs can derive from engaging in global collaboration. The key question: "is global collaboration associated with better performance?" is still open to debate.
- **Individual-level collaboration:** Given the importance which research as well as the public debate give to the latest-generation social networking applications, indicators should be developed on covering their uptake, purpose of use in work-related contexts, and their relation to traditional collaboration tools and channels (can Web2.0 applications present an alternative to e-mail, which has suffered from a decrease in practical value due to the problem of spamming, phishing, etc.?). Indicators should cover involvement in communities of practice as well as collaborative activities of self-employed freelancers ("eLancing").
- **Skills for global collaboration:** Finally, demand and supply of those skills which are unique to work in global collaborative settings is ill-researched. As the European Union has made tangible progress in recent years on agreeing on a core set of core competencies which all Europeans should be equipped with, the specific skill requirements for international collaboration need to be taken into account as well. This is of particular importance since the preparations for the European Adult Education Survey, planned to be implemented across the E in the near future, are well advanced already, but have not so far included proper discussion of the need for data on collaboration-related skills.

### 3 NEWGLOBAL BUSINESS SURVEY: APPROACH AND METHODOLOGY

#### 3.1 Starting Point

As a recent review<sup>6</sup> of available statistics on collaboration at workplace and company level has shown, cross-country data about components which make up the concept of NWE are very scarce. This applies all the more so to data about forms of cross-border co-operation and collaboration.

Against the background of an increasing importance of benchmarking and quantitative target-setting in Lisbon-related EU policy-making, this situation is a deeply unsatisfactory. There is the risk that, while statistical coverage of ICT-related input and intensity indicators is improving (such as take-up of ICTs, e-commerce, e-procurement etc.), an extremely relevant process element, namely virtual collaboration, is not being measured at all. Such inadequacy of the informational base for policy-making can lead to misguided decisions, for example about subjects of financial support and the design of regulatory frameworks.

As an important step towards a benchmarking framework on virtual collaboration and cross-border NWE, NEW GLOBAL contains as a core element a carefully designed business survey which will provide representative data about the diffusion of NWE in Europe.

The main objective behind the survey will be to:

- assess to what extent EU businesses in core sectors (i.e. sectors which are central to the notion of the knowledge economy) make use of virtual collaboration and the other constituent elements of the concept of NWE;
- explore, in particular, how large the share of enterprises is which collaborate with internal or external partners located abroad;
- map patterns of international collaboration in these sectors, and determine the role played by virtual collaboration technologies in these activities;
- explore whether there is an association between (on the one hand) use of national/cross-border virtual collaboration and NWE, and (on the other hand) parameters of economic performance and innovative activity;
- obtain evidence about drivers (market conditions, regulatory frameworks, competition etc.), success factors and impacts of national and international virtual collaboration and NWE.

The survey will not cover the entire population of EU businesses, but focus on selected industries only. The reason for this is that the potential for benefits to be derived from cross-border collaboration differs substantially between economic activities/sectors/industries. Because of the project's focus on high-qualified knowledge work and because of the outstanding importance of the sector for the overall competitiveness of the EU economy, NEW GLOBAL's business survey will focus on enterprises in high-tech manufacturing and knowledge-intensive services only.

The project will develop and prototype a number of indicators following a tried-and-tested procedure for survey preparation, execution and result analysis. This work will be carried out through rapid prototyping and take due account of the established indicator quality criteria developed for the Eurostat Quality Concept. The result, the NEW GLOBAL set of indicators on international NWE, will then be operationalised into survey instruments.

Piloting will be carried out as a three-step process including laboratory pre-testing (using cognitive techniques), field pre-testing, and pilot surveys collecting "real" data. The group targeted will be decision-makers in firms/businesses (enterprises). For the reporting unit, different options exist from which the most adequate will be selected once the survey content

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<sup>6</sup> see Gareis (2006a)

has been fixed. Most likely, either the person in charge of R&D or the person in charge of human resources will be chosen.

### 3.2 Subject of the Interviews

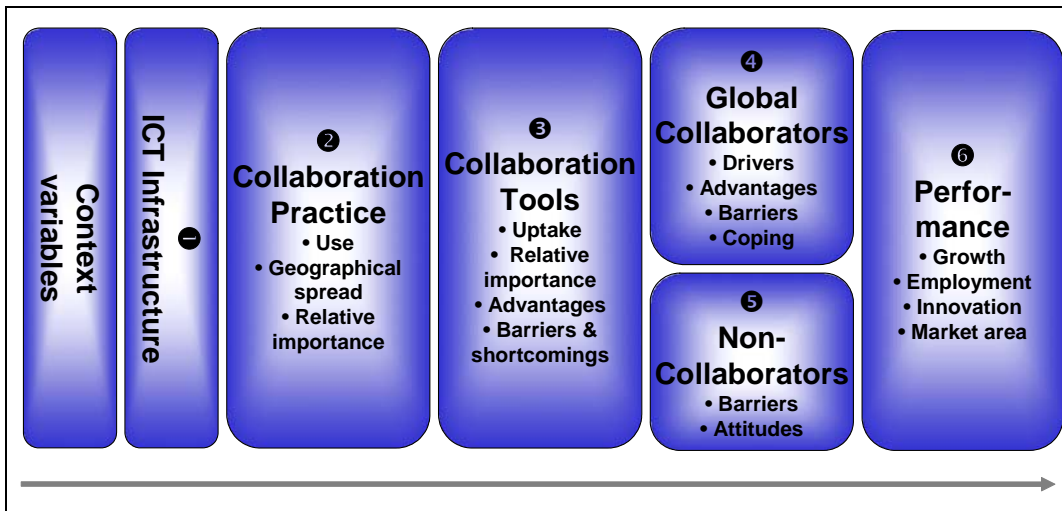
The collection of primary survey data will build upon the work undertaken in the first stage of the project. WP1, the conceptual framework and state of the art synthesized from existing research and policy practices, defined key terms and concepts and identified various indicators and existing statistics on the subject at hand. For this purpose, the project looked at the well-established measures of the Information Society and Knowledge Economy, which have been defined in the context of the eEurope action plans, the i2010 strategic framework, and related work by the Voorburg Group, OECD, Eurostat, national benchmarking efforts, and other sources. Based on the result of this review, it was decided which of the identified indicators should be included in the pilot business survey to be carried out. The following are topics which we attempt to cover in the interviews. Note that not all respondents will be asked about all topics but that the interview will be tailored (by means of branching and filter questions) to the types of respondents. For example, companies not or scarcely using virtual collaboration methods will be asked about barriers while firms which make extensive use of virtual collaboration will be asked about problems encountered and coping mechanisms.

Comment [m1]: What these letters mean?

#### 3.2.1 Introduction

In order to be able to provide robust insight for meeting the main objective behind the survey, a number of variables need to be collected.

- **Objective:** “assess to what extent EU businesses in core sectors (i.e. sectors which are central to the notion of the knowledge economy) make use of virtual collaboration and the other constituent elements of the concept of NWE”. **Data requirements:** Information about the share of companies that engage in collaboration with external organisations in general, and about the tools and ICT applications which they use for this purpose.
- **Objective:** “explore how large the share of enterprises is which collaborate with internal or external partners located abroad”. **Data requirements:** Information on the location of external location partners, and the relative importance of cross-border collaboration as opposed to collaboration with domestic partners.
- **Objective:** “map patterns of international collaboration in these sectors, and determine the role played by virtual collaboration technologies in these activities”. **Data requirements:** Information about the relative significance of ICT-based collaboration tools, including latest-generation applications such as Wikis and blogging, for collaborative activities.
- **Objective:** “explore whether there is an association between (on the one hand) use of national/cross-border virtual collaboration and NWE, and (on the other hand) parameters of economic performance and innovative activity”. **Data requirements:** See above, plus outcome indicators including growth in turnover and employment, recent innovative activity, and perceived ability to deal with an increase in global competition.
- **Objective:** “obtain evidence about drivers (market conditions, competition etc.), success factors and impacts of national and international virtual collaboration and NWE”. **Data requirements:** Indicators on the extent to which certain drivers (as discussed in the literature) are perceived as having influenced the decision to collaborate globally and to use NWE. Information about the contingencies which influence the success of cross-country virtual collaboration. Variables on NWE uptake and intensity of use, together with context variables to control for statistical co-determination, as inputs for multivariate analysis into associations between NWE uptake and outcomes at company level.



**NOTE:** The contents of the survey instrument, as discussed below and reproduced in the annex of this report, is preliminary. It is based on the stage of instrument development prior to discussion with the survey organisation, to pretesting, and to reception of feedback from Commission Services and the project reviewers. Minor changes and, in particular, cuts in length will be likely as to ensure an optimal interview flow, easy comprehensibility, and an overall average interview duration which stays within the limits set by the overall survey budget.

### 3.2.2 Variables

#### *Size, sector, geographical structure*

The size and the company sector can be expected to be important predictors of the incidence and intensity of collaborative and innovation-related activities within a company, as the data collected by the European Innovation Scoreboard, the eBusiness W@tch, the Innobarometer etc. clearly show. For this reason, they need to be collected in order to correctly interpret the data to be gathered. The data are also necessary for the sampling procedure, as a stratified sampling approach will be used to ensure that the composition of the sample represents the composition of the total population in this respect.

Geographical structure here means whether the enterprise is part of a multi-site company, and if so where the other establishments of the company are located (only within the same region or also in other regions within the same country, in other EU countries, or outside of the EU). This information is important as a potential determinant of the probability of cross-country collaboration, and also as a filter question to establish whether it is possible to ask questions about intra-company but cross-country collaboration.

#### *ICT infrastructure*

Questions about uptake of Internet and type of access (speed, i.e. broadband vs narrowband/midband), the existence of an intranet or other type of LAN, and the technical possibility for employees to remotely access the company computer system from outside of its premises (remote access).

#### *Collaboration practice*

In this module, respondents are asked to report about the extent to which the company is involved in collaborative projects with external companies or institutions, and if so whether these stretch across national and EU borders. The type of partner for collaboration is

covered as well. The final questions in this module deal with the relative importance of collaborative activities within and across borders for the company at large.

#### *Collaboration Tools*

Use and relevance of communication channels and tools, and of collaboration tools, are subject of the first set of questions within this module. The former includes traditional methods such as face-to-face meetings and the telephone. The latter extends to the latest generation of social networking applications (e.g. blogging, wikis). It remains to be seen in the pretests whether awareness about these latest-generation tools is big enough to ensure valid results. The questionnaire then deals with the degree to which available online collaboration tools are sufficient for the purpose of collaboration with externals. Possible reasons for non-usage (barriers) are also enquired.

#### *Global collaboration*

The special issues which revolve around collaboration with foreign and, in particular, non-EU companies and institutions are subject of this module. The first questions refer to the drivers or reasons for taking up cross-country collaboration, and to the criteria which are used for selecting partners for this purpose. The instrument also deals with differences in perception about the ease of collaboration depending on the geographical/cultural situation of the collaboration partner (distinguishing mainly between EU, former USSR, Asia, North America, and Latin America). The final question in this module explores whether the respondent company has developed closer relations with foreign companies and institutions in the recent past, and how it expects the respective trends to continue in the near future.

#### *Barriers to global collaboration*

An extensive item list is used to assess barriers and challenges perceived or encountered in relation to cross-border collaboration. This is a key question to be targeted not only at companies that are collaborating with foreign companies or institutions already, but also those which are not doing so yet.

#### *Further context variables and performance indicators*

These include trends regarding turnover, competitive position and employment. Age of the company and its main geographical markets are additional context indicators which are expected to be important explanatory factors for NWE take-up and usage patterns. Finally, a number of well-established indicators on innovative activity are used to explore the extent to which the company has introduced product, process or organisational innovations in the recent past.

### **3.3 Indicator Development**

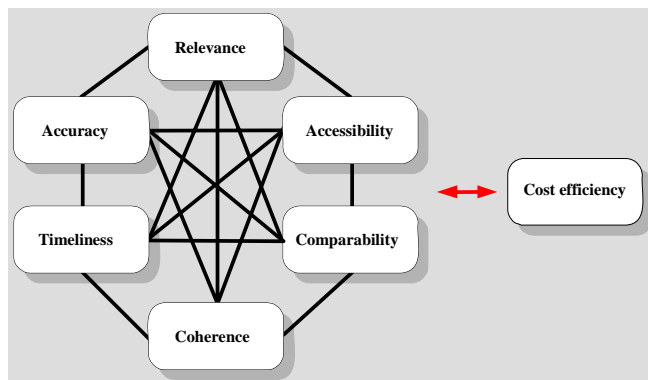
A central element of indicator development will be operationalisation. This will be done as an iterative process, analogous to "rapid prototyping" of software modules, in which operationalised component variables are subject to pre-testing and consistency tests. In the process of operationalisation, indicators will be broken down into component questions and variables suited to empirical survey techniques and appropriate target populations. Effective data gathering instruments will be designed in order to guarantee high validity, feasibility and cost-efficiency of the benchmarking exercise.

Data on the observation units foreseen (businesses in selected industries/sectors) in general need to be collected through interview surveys, since other sources of information (such as official registers) do not provide the statistics sought, lack contextual information needed for interpretation, and/or are hard to collect for technical or legal/ethical reasons (data protection/privacy).

Indicator development will be guided by a set of quality criteria which have been developed in the context of the BISER project and subsequently harmonised with the Eurostat Quality Concept<sup>7</sup> used for assessing the EU's Structural Indicators. The quality framework, which is informed amongst others by the Handbook on Design and Implementation of Business Surveys issued by the European Commission (1998), breaks down quality of statistics, following the concept of Total Quality Management and Total Survey Design, into relevance (outcome focus), validity of estimates, timeliness and punctuality in disseminating results, accessibility and clarity of information, and comparability of statistics and coherence of underlying concepts. Another criterion not of quality, but closely related to it, is cost-efficiency. In fact there is a trade-off relationship between costs and quality criteria.

Particular emphasis will be placed upon ensuring that

- Indicator design is guided by the requirements of the target audience (outcome focus) and aims to produce a set of indicators which can be applied in the larger context of the European Statistical System;
- Instrument design for interview survey maximises validity of measurement;
- Cross-cultural sources for bias (e.g. translation) are fully accounted for, and controlled;
- Sampling procedures are adequate for the task concerning sampling error and, in particular, avoidance of non-sampling error (bias);
- Not only comprehensive results, but also raw data are made available to the research community after the analysis by the project team is accomplished<sup>8</sup>;
- Comparability with existing statistical concepts and data sources is striven for except in cases where there are good reasons to divert from them;
- The ratio between the added value from data gathering on the one hand and costs (including response burden, which is of special relevance in the case of business surveys) on the other hand is maximised.



The resulting survey instrument (questionnaire) will be presented to the EC for commenting. Further test iterations will take place for those indicators/indicator components where issues are raised.

### 3.4 Sampling

#### 3.4.1 Industry Sectors

The **survey** itself will not cover the entire population of EU businesses, but focus on selected industries only. The reason for this is that the potential for benefits to be derived from cross-border collaboration differs substantially between economic activities/sectors/industries. Because of the project's focus on high-qualified knowledge work (see section 1.4) and because of the outstanding importance of the sector for the overall competitiveness of the EU economy, NEW GLOBAL's business survey will focus on enterprises in high-tech manufacturing and knowledge-intensive services only.

<sup>7</sup> See Eurostat Working Group (2003) 'Standard Quality Report'

<sup>8</sup> To be agreed upon with the European Commission.

**High-tech manufacturing and knowledge-intensive business services (according to NACE Rev. 1.1 nomenclature)**

The sector is defined by Eurostat as including the following activities (at NACE 2 digit level):

High-tech manufacturing: Manufacturing of office machinery, computers, radio, television, communication equipment, medical precision and optical instruments, watches and clocks (NACE 24.4, 30, 32, 33, 35.3).

Medium-high tech manufacturing: Manufacture of chemicals, machinery and equipment n.e.c., electrical machinery and apparatus n.e.c., transport equipment (NACE 24-24.4, 29, 31, 34, 35.2, 35.4, 35.5).

Knowledge intensive business services (KIBS): Computer and related activities (NACE 72), Research and development (NACE 73), and:

(a) Professional business services that consist of: legal, accounting, book-keeping and auditing activities; tax consultancy; market research and public opinion polling; business and management consultancy (NACE 74.1);

(b) Architectural and engineering activities and related technical consultancy (NACE 74.2);

(c) Technical testing and analysis (NACE 74.3);

(d) Advertising (NACE 74.4);

Note: The Eurostat definition of KIBS includes 74.81 (Photographic activities) and 74.83 (Secretarial and translation activities) as well, but these should be excluded from the sample.

### 3.4.2 Unit of Observation

The survey should be targeted at enterprises rather than establishments.

Only enterprises of a certain size are to be sampled, which here means for example with firms with at least 5 staff or more employees. Smaller and micro-enterprises are excluded, if this is necessary as any attempt to cover them would be likely to lead to avoid distorted findings as a result from uneven coverage of micro enterprises in list sources. According to previous experience, this problem would seriously affect the validity of outcomes is the case in many most European countries.

In order to ensure that valid data are collected, it is suggested to focus on collaboration-related activities in R&D only, rather than in the company at large. This would mean that respondents are asked to refer to their unit only (rather than the whole company) when responding to the questions. It remains to be discussed with the survey organisation whether this approach is feasible.

### 3.4.3 Unit of Response

The unit of response are key decision-makers in enterprises (details to be agreed upon with survey organisation). If NWE in R&D is selected as research focus, respondents should be the heads of R&D or senior managers with R&D responsibility (in manufacturing firms) and equivalent function holders in service firms.

Possible screening procedure for interviews would be similar to the following (used within the context of the European eBusiness Watch):

*Good morning/good afternoon. My name is ... and I am calling from... [name of institute].*

*We are currently conducting a survey in several countries of the European Union. The survey is about innovation and the role which collaboration with external parties plays for it.*

We are talking to people who are responsible for or take part in decisions in this area in their company, for instance in the research and innovation department or in a management position. [...]

What is your position in your company? Which of the following is the most appropriate?

- Owner / proprietor (in smaller companies)
- Managing director / board member
- Head of research and
- Innovation or Chief Technology Officer
- Other senior member of a department which is strongly involved in research or innovation
- Other: .....

#### 3.4.4 Country Coverage

In order to generate findings which are representative for the companies in these sectors in the EU, the sample will be drawn from list sources covering a minimum of nine EU Member States, i.e. France, Germany, Italy, Poland, and the UK (since these countries together account for the large majority of EU enterprises) as well as the Netherlands, Finland, Hungary and a Baltic country (because of their special interest for the topic in question, which has been confirmed in the literature). This would imply 9 different interview languages.

The sample size will be chosen in order to be statistically sufficient for carrying out robust, in-depth multivariate analysis. The current estimate is that an overall sample size of n=2,000 will be required for this purpose, with a minimum of n=1,800 successful interviews.

### 3.5 Survey Methodology

#### 3.5.1 Duration and Timing

Estimated duration per interview is 10 minutes on average (excluding initiation). Maximum interview duration may be considerably higher depending on branching instructions.

Data needs to be ready for analysis before the Christmas break 2007. This would leave the first 2 months for data cleaning and basic analysis, plus two more months for in-depth multivariate analysis.

The final decision about the features of the survey is to be taken at the official project review meeting which is scheduled for 14 September. Only then will it be possible to conclude the contract with the survey organisation.

According to IPSOS, the survey organisation from which an offer has been obtained and included already in the proposal for this study, the fieldwork could be accomplished before 7 December, i.e. before the Christmas break, if the final questionnaire is delivered on 1 October.

#### 3.5.2 Approach to Quality Management

Indicator piloting will be carried out as a three-step process. The reason for choosing such a careful procedure is as follows: Carrying out a survey in different countries and cultural areas poses some considerable challenges upon research<sup>9</sup>. Most prominently, the translation of questionnaires is a very delicate issue to deal with. Questions are commonly regarded as stimuli that need to be set consistently for all participants if analysis should lead to reliable results – and much of questionnaire design literature attempts to meet the challenge that

<sup>9</sup> See Harkness et al. (2003)

stimuli are understood unequivocally by respondents even if they share a common cultural backgrounds and language. This challenge is even aggravated when doing international survey research. NEW GLOBAL will meet the challenge by applying three tried-and-tested methods:

- laboratory pre-testing;
- field pre-testing;
- plausibility tests and constant feedback during collection of "real" data (fieldwork).

Survey research has made significant progress in refining **laboratory pre-testing** through the application of cognitive testing in recent years. The problems with traditional field pre-testing (i.e. simply testing the completed questionnaire with a number of subjects from the observation population) is mainly that respondents hardly utter comprehension problems, if they recognise them at all. To account for this problem, cognitive techniques are deployed before the actual field phase. They do usually not reproduce realistic field circumstances. Cognitive techniques are always "pro-active" techniques, i.e. involve reassuring with the respondent about his answers/ ways of answering to a question. Laboratory pre-testing will be done by researchers who are deeply involved with the projects hypotheses and the instrument development. Test persons will be informed about the test situation and usually be rewarded. Despite its usually non-standardised situation, we intend to standardise cognitive testing as much as possible. This will ensure comparability of the results and more reliable conclusions.

**Field pre-tests** will be carried out to check the proper functioning of the interview procedure. They will also be used to identify any remaining problems/issues with the instrument and the interview procedure – such as those resulting from inclusion of questions in multi-contractor (omnibus) surveys. Field pre-testing will make use of a number of techniques including interviewer de-briefing, respondent de-briefing, behaviour coding, and analysis of response distributions.

### 3.5.3 *Fieldwork, Data Delivery and Processing*

Fieldwork will be subcontracted to a specialised survey organisation.

For survey execution, the preferred option is Computer Aided Telephone Interviewing (CATI). Telephone interviews offer the advantage of quick and reliable data collection from a central telephone unit. CATI also offers best field control, automated sample administration, simultaneous data entry and permits a complex branching of the interview flow depending on filter questions and thus allows to apply questions tailored e.g. to the respondent firm's equipment status etc.

Once the data has been collected, it will be analysed (using SPSS and Excel software packages) in order to assess coherence/completeness, validity of measurement, comparability across cultures (i.e. countries, language areas), statistical relevance (explanatory power) and cost efficiency. This evaluation will result in scores of the "technical added value" of indicators, which will inform the subsequent recommendations to be made with regard to inclusion of indicators and survey items into established business surveys in Europe.

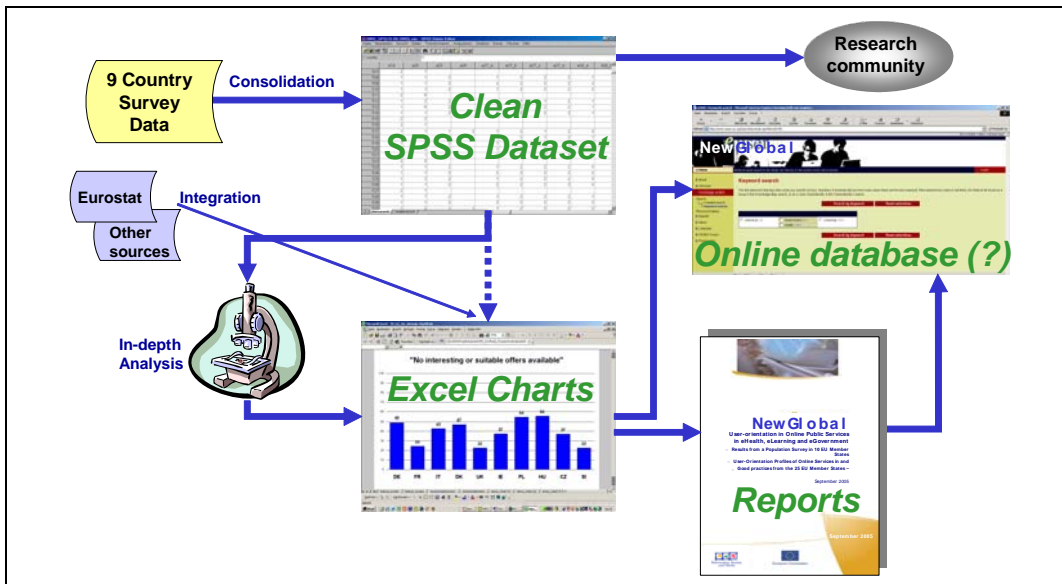
Results will be presented in tabular and chart format, and used extensively for the dissemination and promotion activities of NEW GLOBAL. In addition, the survey findings and the raw dataset will be of high value to the European Commission, as they both can be re-used and exploited for answering particular research questions even after the end of the project duration. The statistics produced can also provide important quantitative evidence and illustration for use in subsequent Commission publications.

## 4 EXPLOITATION OF THE RESULTS

### 4.1 Data Processing

The raw dataset will be checked, processed and analysed using standard software packages (SPSS, MS Excel). Results will be presented in tabular and chart format, and used extensively for the dissemination and promotion activities of NEW GLOBAL (see Figure 18).

Figure 18: Utilisation of WP2 data within the project



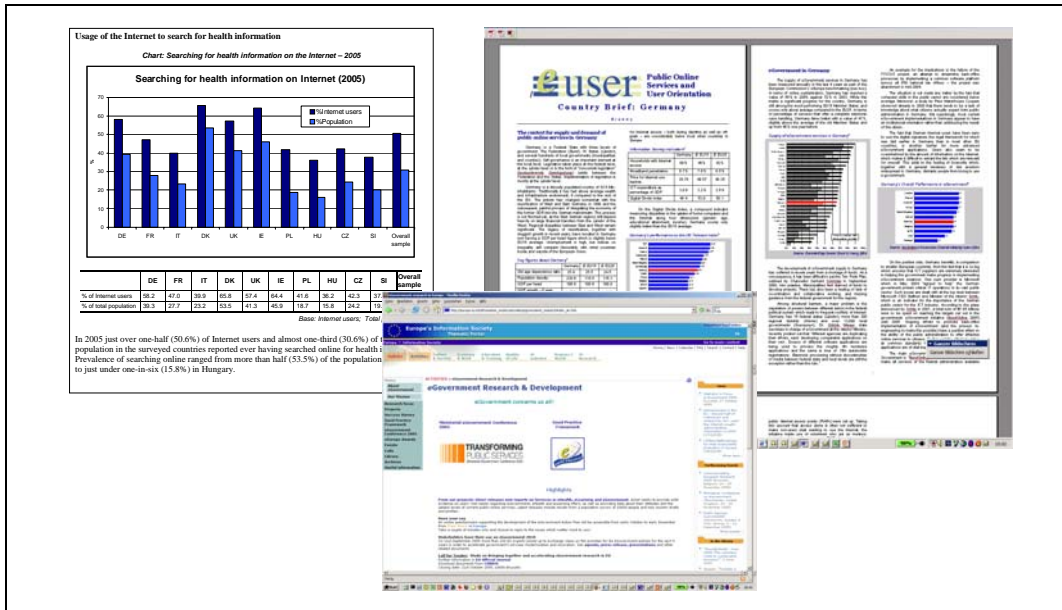
### 4.2 Final Outputs

The main outputs from the survey WP are expected to be:

- Primary statistical data from the pilot study (to be included in 2<sup>nd</sup> Interim Report, Final Report, Chart Report, and on website);
- Online knowledge repository giving interested persons easy access in suitable for-mats to the findings of the survey (on project website);
- A coherent set of indicators to be used to capture options, risks, cost and gains of NWE (to be introduced and discussed in Final Report).

Results from the survey can be used for a variety of optional project outputs such as reports, glossy brochures, flyers, webpages, scientific papers and Powerpoint presentations.

Figure 19: Possible formats for dissemination of WP2 results



In addition, the survey findings and the raw dataset will be of high value to the European Commission, as they both can be re-used and exploited for answering particular research questions even after the end of the project duration. The statistics produced can also provide important quantitative evidence and illustration for use in upcoming Commission publications.

## 5 LITERATURE

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## **6 DRAFT QUESTIONNAIRE**

See separate file