

Indicators for the New E-Business Environment: Challenges for Statistics and Research

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Abstract

To help policy-makers define their initiatives, and to monitor the effectiveness of these policies, some indication of progress and of areas requiring active support is essential. This requires that policies are based on measurable targets have been agreed upon, and that adequate indicators and data relating to these targets are available. However, while setting realistic, concrete and achievable targets is increasingly acknowledged as an indispensable task for any policy making process, it proves to be probably one of the most difficult challenges for policy makers in the field of electronic business. As policies move on to stimulate a more sophisticated usage of e-business and eventually a full integration of e-business into the regular business practices, determining metrics and appropriate targets becomes more difficult. This paper explores some of the difficulties related to target and benchmarking oriented policy making in the area of e-business policies. It discusses the strengths and weaknesses of e-business indicators and indicates the way forward from a "static" to a "dynamic" framework for policy oriented e-business indicators.

Note

Major parts of this paper draw from publications and research of the e-Business W@tch, which was launched by the European Commission, DG Enterprise, in January 2002 to monitor the maturity of electronic business from a sectoral point of view. The author is the coordinator of the e-Business W@tch. See: www.ebusiness-watch.org

1 Introduction

European policy is increasingly focused on promoting business practices and new ways of working that will increase the competitiveness of enterprises and provide the economic and social foundation for the knowledge economy in Europe. The eEurope 2002 Action plan provided the basis for targeted actions to stimulate the use of the internet for accelerating e-commerce, acknowledging that "electronic commerce is already developing dynamically in inter-business trading [...]" and that "it is important for SMEs not to be left behind in this process [...]." The eEurope 2005 Action Plan, endorsed by the Seville European Council in June 2002, confirms and builds further upon these objectives with Action 3.1.2. "A dynamic e-business environment", which defines the goal "to promote take-up of e-business with the aim of increasing the competitiveness of European enterprises and raising productivity and growth through investment in information and communication technologies, human resources (notably e-skills) and new business models".¹

To help policy-makers define their initiatives, and to monitor the effectiveness of these policies, some indication of progress and of areas requiring active support is essential. Despite the considerable amount of studies and market research on electronic business (and especially on electronic commerce), there used to be a lack of reliable empirical information about the extent, scope, nature of and factors affecting the speed of e-business development at the sector level in an internationally comparative framework.

Against this background, the European Commission, DG Enterprise, launched in January 2002 the *e-Business W@tch*. During its 18-month period of operation, the *e-Business W@tch* carried out Sectoral e-business impact studies for 15 sectors of the economy and two representative surveys of close to 13,000 enterprises from these sectors [cf. European Commission 2003b]. Considerations presented in this paper are largely based on work of the *e-Business W@tch* and are intended to contribute in benchmarking progress and in assessing how electronic business developments can be further enhanced to strengthen the competitiveness of European businesses.

2 Setting objectives and quantitative targets for e-business policies²

At both European and national level, many of the necessary steps have been taken to address those electronic business issues which are relevant for policy. The legal framework

¹ eEurope 2002 Action Plan, prepared by the Council and the European Commission for the Feira European Council, 19-20 June 2000; eEurope 2005 Action Plan, COM(2002)263 final

for e-commerce has been widely established and the telecommunication markets are being rapidly liberalised across Europe. The eEurope initiative provides the framework to foster e-applications in many areas of public interest. In this context, e-government has been identified as a key priority, followed up by a series of actions to promote e-procurement and other public services delivered on-line.

Yet, in spite of these “horizontal” policy actions, there are strong arguments to further support the use of ICT and e-business by SMEs, in particular the full integration of ICT in business processes, with SME specific measures. However, such specific e-business policies in support of SMEs call for a sound policy framework based on a clear identification of the specific needs to be addressed, as well as on a clear definition of targets to be achieved. The Industry Council has rightly pointed out the need for realistic and measurable targets for e-business policies and invited the Member States and the Commission to “intensify dialogue, exchange regularly experience, identify specific goals for e-business policies and to share best practices.”

In order to develop a target-oriented framework for e-business policies, it is helpful to have a look at conceptual and methodological principles used in benchmarking. It is a common principle of benchmarking processes to organise the topic(s) of analysis by breaking them down into several levels of a hierarchy. As a general rule, benchmarking experts argue that it is extremely important to be as specific as possible in defining success factors and the metrics (here: targets) attached to them. For example, it is possible to use a system of three layers of specificity. In the following, we call these layers "challenges", "objectives" and "targets".

- **Policy challenges** – the "mission statement": Policy challenges define a broad subject area for investigation. The subject is usually too broad to involve any type of direct measurement. They are a kind of mission statement that needs to be operationalised by breaking it down into objectives and targets. Challenges are usually qualitative by nature. The Lisbon objective that the European Union should become the "most competitive and dynamic knowledge based economy" is a good example.
- **Policy objectives** – a set of tasks related to a policy challenge: Objectives, in a way, translate policy challenges or implications into more concrete concerns which can be the basis for the specification of policy actions, initiatives or programmes that address these objectives. The objectives can also be regarded as the "critical success factors" (CSFs) with respect to the policy challenges identified.

² The considerations in this part of the paper are based on the Communication from the European Commission: Adapting e-business policies in a changing environment: The lessons of the Go Digital initiative and the challenges ahead. COM(2003) 148 final.

- **Policy targets** – the measurable output and outcome of policy actions. While setting realistic, concrete and achievable targets is an indispensable task by itself, it proves to be probably one of the most difficult challenges for policy makers in this field. As policies move on to stimulate a more sophisticated usage of e-business and eventually a full integration of e-business into the regular business practices, determining metrics and appropriate targets becomes more difficult. They relate to the input or (physical) output of policy actions, specifying what tasks should be accomplished in order to achieve the desirable impact. Many of the tasks specified in the eEurope 2005 Action Plan are activity targets.

What challenges, objectives and targets have in common that they should be specified with a deadline until when they are supposed to be achieved and that they should be measurable, whether directly or by means of selecting suitable indicators.

The definition of concrete targets for policies is a prerequisite for empirically benchmarking the impact and success of policy actions. The value of benchmarking to policy development has become evident in the framework of the eEurope Action Plans which have used benchmarking through the open co-ordination method (OMC) to assess progress from the beginning. Benchmarking can be further exploited by exchanging policy good practices, as it is not only a tool to monitor the progress made in specific areas but most importantly, to stimulate the search for better focused and more efficient policies.

In the area of e-business, however, establishing solid impact targets for policies is particularly complex. The rapid technological development makes it difficult to make forecasts what is desirable in the future. The assumptions about the future development and implications of electronic business is based on "best available views" that need not necessarily turn out to be correct, as some misplaced targets and wrong expectations in the past have demonstrated. Furthermore, the pervasive character of ICT in all areas of business as well as everyday life makes it difficult to define the scope of policy actions and consequently what should be the appropriate targets.

An important decision to be taken for the definition of targets is whether they should refer to impacts and/or outputs only or if they can also refer to activities and inputs. Ideally, a policy initiative starts with the definition of challenges and (long-term) objectives and possibly (short- and medium-term) goals. The next step is the allocation of inputs which are used to implement certain activities and processes. These activities should lead to some type of output, which then have an impact on the conditions that are subject to the objectives defined in the beginning. Target marks can therefore operate on different levels of such a framework. They can relate to any of the stages described, but in most cases describe either inputs, outputs or the impact of an initiative.

3 Defining adequate e-business indicators

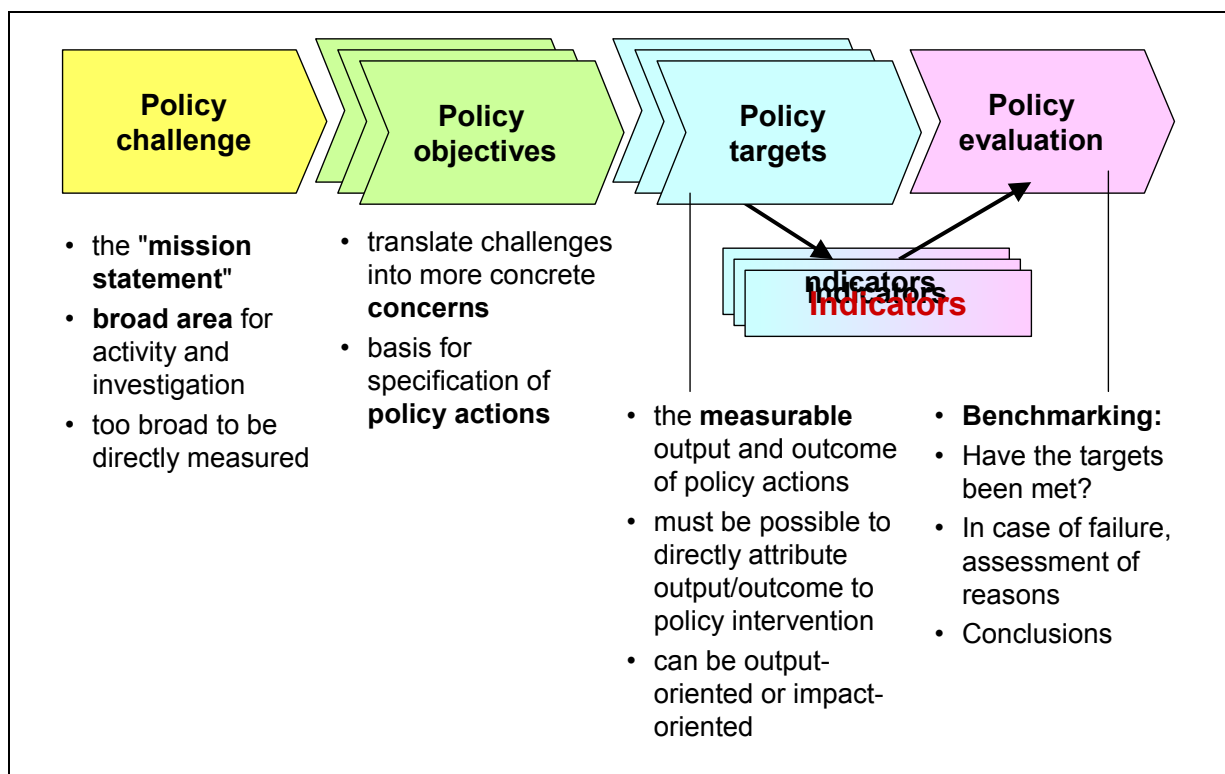
3.1 The role of indicators for policy definition and assessment

In the process of defining policy challenges, objectives and targets for e-business, indicators play an important role in two ways.

- (a) Indicators as a tool for deciding on policies: Indicators are needed to clearly define quantitative, measurable targets.
- (b) Indicators as a policy evaluation tool: Indicators can be used as success criteria against which to evaluate and assess whether policies have successfully achieved the specified targets.

If this approach is used, policy making is a circular process where setting quantitative targets implies that an evaluation takes place whether targets have been met after an agreed period of time, which then leads to the definition of new targets. The following exhibit depicts the stages of this process.

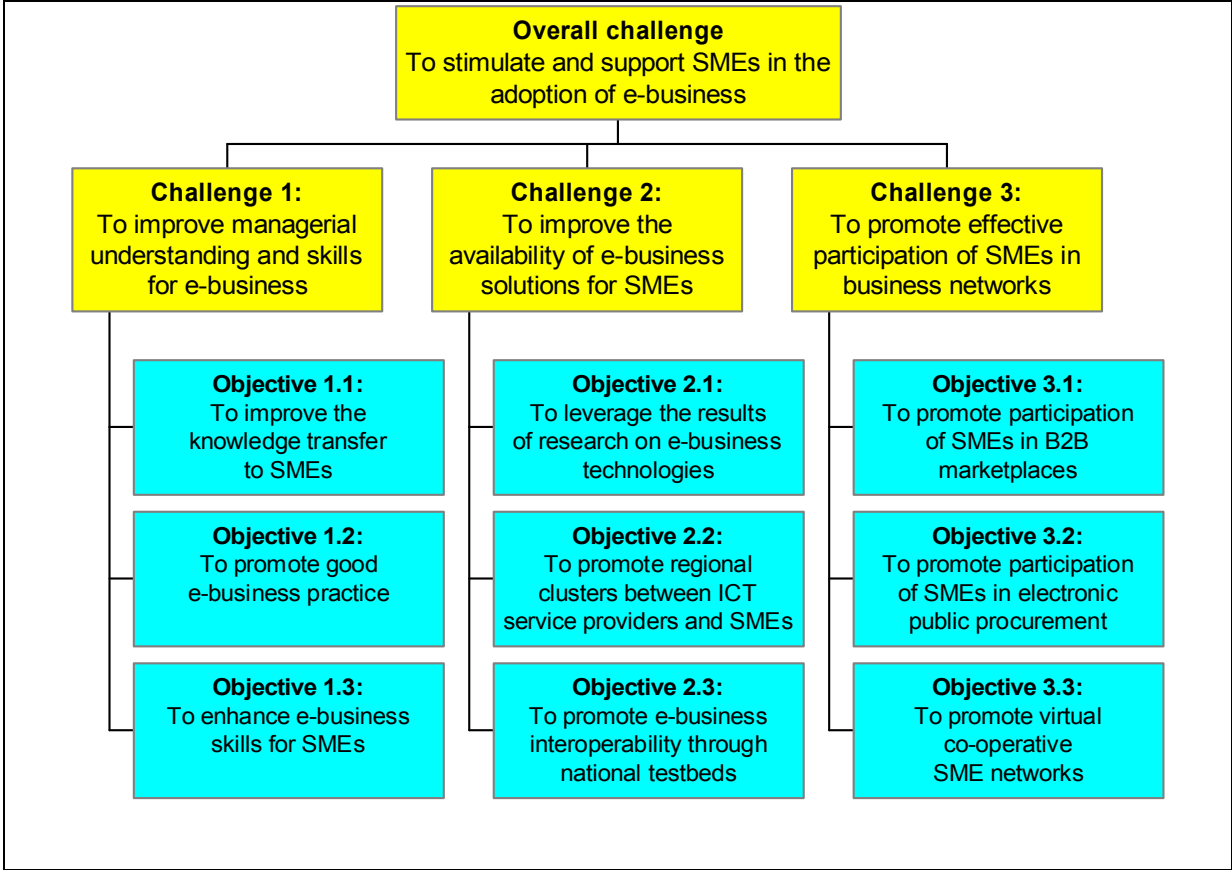
Exhibit 1: Benchmarking as a policy tool: from challenges to evaluation



In its Communication on "Adapting e-business policies in a changing environment: The lessons of the Go Digital initiative and challenges ahead" [European Commission, 2003a], the Commission proposes a framework model for SME related e-business policies, based on

challenges, objectives and targets. The framework groups objectives under three main challenges, namely to improve managerial understanding and skills, to improve the availability of e-business solutions for SMEs, and to promote effective participation of SMEs in business networks.

Exhibit 2: The EC framework for SME policies



3.2 Readiness, activity, impact: types of e-business indicators

An OECD discussion paper, focusing on enterprises' rather than countries' e-readiness, has defined that is that '**readiness for e-business** is the capability of a company to engage in electronic transactions' [Colecchia/Pattinson/Atrostic, 2000]. In this approach, this capability comprises several features ranging from the appropriate network access (including sufficient bandwidth), to internal hardware and software solutions as well as to the procedural and managerial readiness to deal with on-line transactions from simple web presence through to fulfilment of customer orders and the relating after sales services.

E-business activity can refer (i) to the frequency of use of e-business applications, measured as the share of enterprises making use of a specific application, and (ii) to the relative importance (the actual "intensity") of this usage. Accordingly, intensity indicators can be restricted to simple "yes" or "no" indicators ("Does your company sell online?"), or can go

one step further and provide measurements in absolute figures, such as "number of visits to the homepage", "the volume of online sales", "the number of transactions completed" or "the number of goods offered via the internet". While these figures are helpful to observe the development of e-business over time, they are not very meaningful for documenting the actual importance of electronic business. Therefore, e-business usage should also be captured in terms of shares of e-business as a percentage of all business activity.³

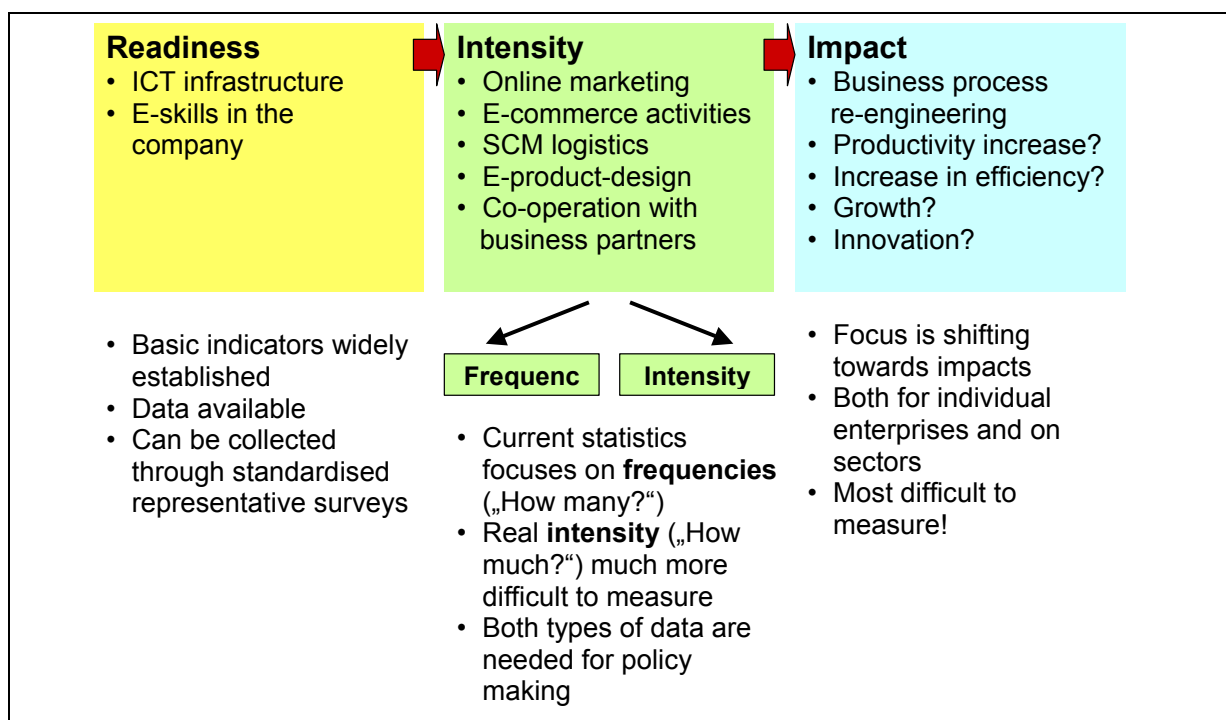
Apart from the intensity of use, usage indicators should document which applications are most frequently adopted. The application categories can only be differentiated in a rather summarised way, in order not to overload the survey. Hence the three categories given in the tender might be used as a manageable approximation. Usage may thus be divided into (1) general information and communication management, (2) specific use of ICT for particular business processes, and (3) e-commerce. This allows a separation of e-business and e-commerce activities and divides internal usages into information management and business process management.

Due to the complex structure of e-business related innovations, it is particularly difficult to identify **e-business impacts**. All the difficulties and caveats of technology assessment as well as of structural change and its impact on the economy apply here [Cohen et al., 2001; Preissl, 2000]. The impact discussion is furthermore blurred by the fact that impacts at the firm level, the market level and the level of the economy are usually not clearly distinguished. In addition, 'impact' needs a specification of the variables that are affected (impact on what?). Causal relationships are often not direct, but indirect, i.e., the effects of investment in networks are only made effective via additional investment in organisational change, and they are subject to a whole number of economic variables, such as elasticities of demand and supply, business cycle conditions, interest rates etc.

Of particular interest for the opportunities arising for SMEs is the impact on competition. Again, the analysis should be limited to information that can be directly asked from the managers addressed in company surveys. Any attempts to deduct those impacts from other (micro- or macroeconomic) sources run in uncontrollable risks of misinterpreting causal relationships.

³ cf. conceptual framework of the *e-Business W@tch* (www.ebusiness-watch.org)

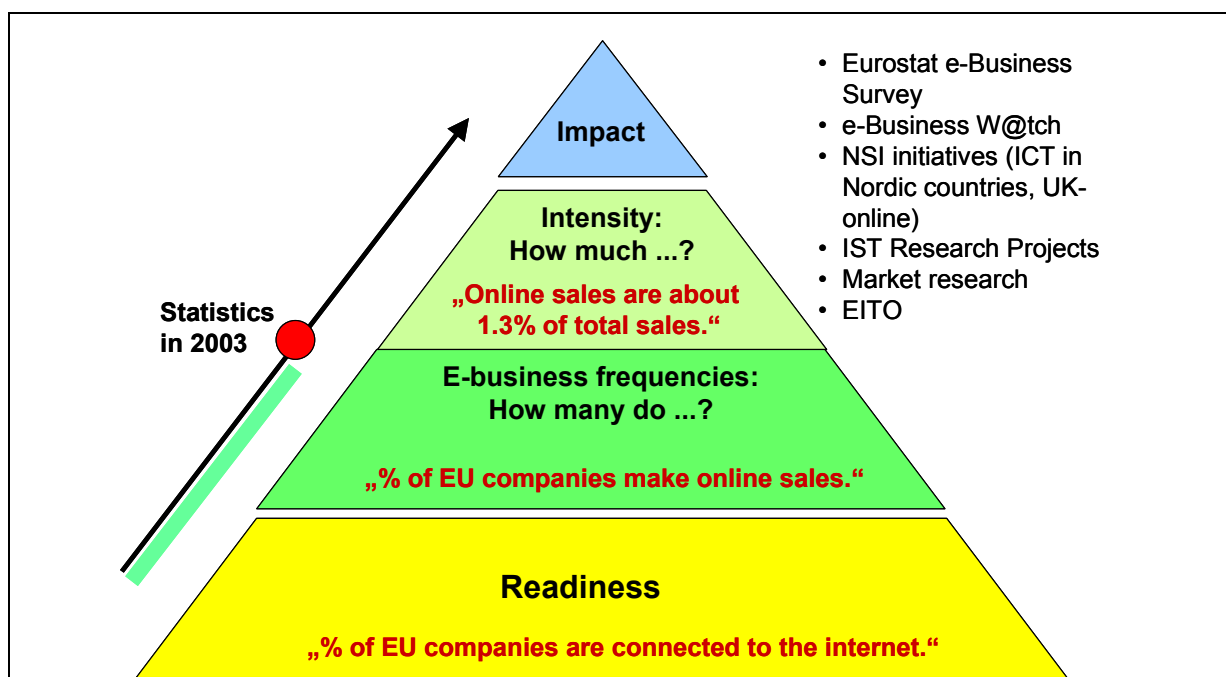
Exhibit 3: Three levels of e-business indicators



European official statistics, including the national statistical institutes, has made an intensive effort to improve availability of statistics on ICT and electronic business adoption of European enterprises. Data on "readiness", as defined above, and about how many enterprises use ICT for various e-business applications are now available for enterprises from many sectors and from all EU countries. The Eurostat ICT and e-business enterprises survey, which was piloted in 2001 and has been continued annually since, special benchmarking surveys of several Member States, particularly in the Nordic Countries and in the UK (in the context of UK Online for business), and the surveys of the *e-Business W@tch* have made important contributions to the availability of data on e-business in Europe.

However, e-business statistics still suffer from a lack of adequate indicators (and, consequently, data) on e-business intensity and, particularly, on e-business impacts. Although it is clear that collecting these data is much more complex and costly than gathering basic data on infrastructure and simple frequencies (yes/no) for e-business activities, it will constitute the main challenge for statistics and research to come up with innovative indicators and improve the data situation with respect to these areas.

Exhibit 4: The current status of e-business statistics in Europe



3.3 Four key challenges for e-business statistics

Following these considerations, it can be concluded that there are four main challenges which statistics and research are currently confronted with in their effort to improve metrics and to deliver indicators with practical value for policy making and evaluation.

Challenge No. 1: The increasing scope of the field of study

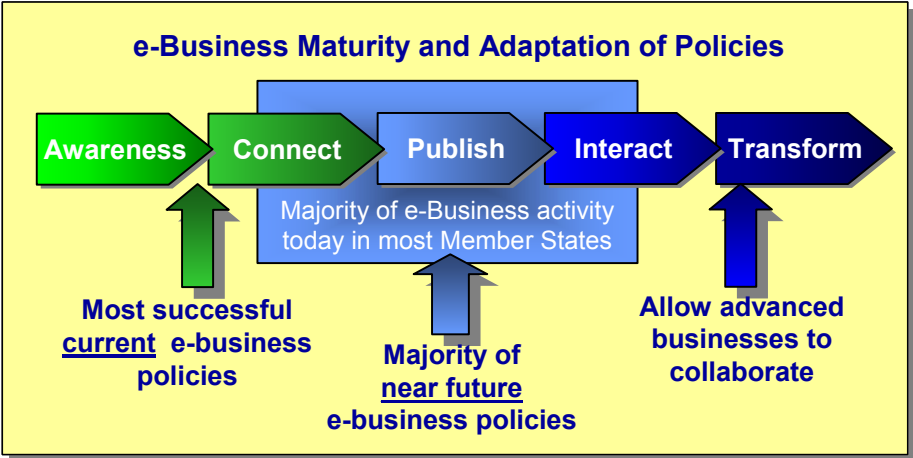
The first challenge is how to translate the increasing integration of ICT based solutions into all business processes into adequate indicators. If all business becomes "e-business", the scope of the field to be covered by ICT and e-business studies becomes borderless. Integration, however, can take very different forms, and it is increasingly difficult to operationalise this issue through using standardised survey questions. It is possible to ask companies whether they use advanced e-business software solutions such as Supply Chain Management or ERP software, but this does not cover the whole range of activities and approaches. In a way, the borderline between „e-business indicators“ and general business indicators is being blurred.

Challenge No. 2: The fast evolution of e-business

The nature of electronic business is developing fast and this obviously has implications for related policies. In a way, policy has to adapt its focus and develop along with the progress companies make in using ICT. While it was a focus of policies that enterprises should get

connected to the internet a few years ago, this target has been accomplished to a large extent. Now, the focus of policies will move to more advanced aspects of ICT usage.

Exhibit 5: E-Business Maturity and Adaptation of Policies



Source: developed from Scottish Enterprise⁴

As policies move on to stimulate a more sophisticated usage of e-business and eventually a full integration of e-business into the regular business practices, determining metrics and appropriate targets becomes more difficult. The design of instruments is necessarily based on assumptions about what is important to measure, to observe, to analyse. Assumptions of the future development, however, are risky and may become obsolete. Furthermore, there are a number of definition problems related to ICT infrastructure and e-business, particularly if data are to be collected through personal interviews.

Challenge No. 3: Measuring impact – filtering out the ICT part

The impact of ICT and e-business on competitiveness has been discussed in many facets. The basic argument behind this link is that ICT and, particularly, e-business stimulate productivity growth and induce product and process innovations. Both effects will enhance competitiveness via lower prices and via a more attractive supply of goods and services.⁵

While productivity gains from ICT usage have been widely discussed in the literature on ICT impacts, an even more lively debate arose, because the expected productivity effects failed to appear at the macro level (as well as in many firms). The debate is not settled yet, and the productivity question has an important impact on company behaviour. So far, empirical evidence is not conclusive, while the OECD reports positive impacts in a majority of firms

⁴ Exhibit is based on a presentation by Maureen McKeown, Scottish Enterprise, at the Workshop on Quantitative Targets for E-Business Policies, Athens, 16-17 January 2003

(OECD 2002). If productivity gains are as difficult to find in e-business scenarios as in ICT investment scenarios in general, the motivation to invest in e-business should not only rest with this indicator.

However, there are other factors as well that contribute to competitiveness, and it is most difficult to assess and filter out the significance of ICT. An important consideration in this context is that standard indicators for the diffusion of e-business related technology and skills levels usually emphasise the technical and neglect the organisational part of e-readiness. Whether ICT and network technology can be used profitably, however, is highly dependent on the necessary adjustments which allow firms to integrate new technical tools in existing workflow systems.

Challenge No. 4: Does one hat fit all?

A fourth major challenge for ICT and e-business statistics is how to cope with different levels of maturity across regions, sectors and enterprise size-classes. Some indicators in ICT adoption that used to be important in early stages of maturity (e.g. "% of enterprises with an internet connection", "% of enterprises having a website") are losing much of their value when a higher level of adoption is reached, if no additional information is provided. For example, a great majority of enterprises in advanced industries today has internet connection, even among the small enterprises. What is of interest now is the quality of the connection and what enterprises actually do with it. This should be reflected by the respective survey instruments.

This has an important implication for the design of survey instruments and the decision on what are adequate benchmarks. On the one hand, it would be preferable to adopt a consistent framework for comparing progress and maturity on an international and cross-sectoral level. On the other hand, there is an inherent danger of comparing apples and pears if, for instance, e-business in tourism is compared to e-business in the manufacture of metal products by using the same metrics and benchmarks.

This issue may step into the political limelight when the Acceding Countries join the European Union in May 2004. As many of these 10 countries are yet on a less mature stage in their overall information society development, it may be difficult to apply some of the benchmarks which are, on the other hand, adequate for advanced economies in the current member states.

⁵ Considerations about the challenge of measuring impact are taken from a paper by Brigitte Preiszl, DIW Berlin, on the " The link between competitiveness, ICT and e-business", November 2002 (prepared for a Special Report to DG Enterprise of the *e-Business W@tch*).

4 A European pilot: The e-Business Index in eEurope 2005

As a very courageous pilot towards measuring progress in the uptake of e-business in Europe from a holistic point of view, the European Commission, Enterprise Directorate General, has developed an aggregate indicator for "e-readiness" – the e-Business Index. It introduces in the list of eEurope 2005 benchmarking indicators a more comprehensive representation of the e-readiness of European enterprises. This should be viewed as an improvement of the initially presented list of indicators, both in terms of the increased usefulness for benchmarking and because the originally included indicator only highlights the aspect of e-commerce activities, at the expense of a more complete picture of the e-business environment. It is expressed in two main dimensions, namely the infrastructure / technology enablers and the organisational / business factors.

Exhibit 6: Component indicators of the eBusiness Index from eEurope 2005

A. Infrastructure / Technology	B. Organisational / Business
<ul style="list-style-type: none"> a1. Percentage of enterprises that use Internet a2. Percentage of enterprises that have a web site/home page a3. Percentage of enterprises that use at least two security facilities at the time of the survey a4. Percentage of total number of persons employed using computers in their normal work routine (at least once a week) a5. Percentage of enterprises having a broadband connection to the Internet a6. Percentage of enterprises with a LAN and using an Intranet or Extranet 	<ul style="list-style-type: none"> b1. Percentage of enterprises that have purchased products / services via the internet, EDI or any other computer mediated network where these are >1% of total purchases b2. Percentage of enterprises that have received orders via the internet, EDI or any other computer mediated network where these are >1% of total turnover b3. Percentage of enterprises whose IT systems for managing orders or purchases are linked automatically with other internal IT systems b4. Percentage enterprises whose IT systems are linked automatically to IT systems of suppliers or customers outside their enterprise group b5. Percentage of enterprises with Internet access using the internet for banking and financial services b6. Percentage of enterprises that have sold products to other enterprises via a presence on specialised internet market places

To derive the value of the overall indicator, a multi-step calculation scheme was defined. The first step involved the re-scaling of component variables based on a procedure originally proposed by the UK Office of National Statistics. The component variables were to be rescaled linearly between their maximum and minimum values, set at 0 and 10 respectively. Weights were then to be set for each component variable and a weighted average calculated for the "A" and "B" subsets, yielding values for each of the two sub-indicators. Finally, a

simple average of the two sub-indicators was to yield the overall enterprise e-business readiness indicator.

4.1 General considerations on compound indicators

Compound indicators are used for a multitude of purposes. In general two objectives can be distinguished. On the one hand indices can be constructed either to measure explicitly uni-dimensional or multi-dimensional (i.e. statistically independent) phenomena. On the other hand indices can be constructed to track changes of a concept over time (e.g. price indices, business climate indices) or to compare and benchmark the performance of several units of analysis against each other (e.g. Human Development Index, Technology Achievement Index, Innovation index). It is however possible to construct an index that has both properties, to compare units at a given time point and track developments over time.

Exhibit 7: A compound indicator for e-readiness: pros and cons

Pros	Cons
<ul style="list-style-type: none"> • Compound indicators can be used to summarise complex or multi-dimensional issues, in view of supporting decision-makers. • Compound indicators provide the big picture. They can be easier to interpret than trying to find a trend in many separate indicators. They facilitate the task of ranking countries on complex issues. • Compound indicators can help attracting public interest by providing a summary figure with which to compare the performance across Countries and their progress over time. • Compound indicators could help to reduce the size of a list of indicators or to include more information within the existing size limit 	<ul style="list-style-type: none"> • Compound indicators may send misleading, non-robust policy messages if they are poorly constructed or misinterpreted. Sensitivity analysis can be used to test composite indicators for robustness. • The simple “big picture” results which composite indicators show may invite politicians to draw simplistic policy conclusions. Composite indicators should be used in combination with the sub-indicators to draw sophisticated policy conclusions. • The construction of compound indicators involves stages where judgement has to be made: the selection of sub-indicators, choice of model, weighting indicators and treatment of missing values etc. These judgements should be transparent and based on sound statistical principles. • The compound indicators increase the quantity of data needed because data are required for all the sub-indicators and for a statistically significant analysis.

4.2 Discussion of methodological issues with a view to the e-Business Index⁶

Avoidance of moving targets: The original scoring technique for the aggregate subindicators proposed in a draft version of the Index involved first rescaling the component variables between their maximum and minimum values set at 0 and 10 respectively, and then calculating a weighted average. This calculation technique had been proposed by the UK Office of National Statistics (ONS) as superior to the use of raw values in the context of benchmarking (Clayton 2002). The problems identified with this approach did not apply to the context presented by ONS, which was the comparative benchmarking of nation states at a particular point in time. Problems arose only in the context of eEurope, where in line with the Lisbon strategy of extending Open Method of Coordination, the success and impact of eEurope policy was to be monitored at regular intervals over time.

It was realised that as soon as multiple measurement points were introduced, the proposed metrics would cause problems of interpretation. Allowing the parameters for re-scaling of component variables to be determined by each sample drawn would effectively create a moving target for eEurope policy. As the maxima and minima, the "goalposts", would shift on each measurement, the threat was to produce artefactual increases or decreases in a measure of e-business readiness, i.e. apparent changes in readiness which did not reflect the underlying real changes.

Further analysis showed that even for static comparison, the method had some potentially serious implications, in that the ability to compare sectors, regions or other subsets of European enterprise would be compromised. For example, suppose that bounds were set by the lowest and highest penetration in a EU15 member state, then analysis was extended to include other countries - candidate countries, Russia, USA, Japan, Korea etc. If the minima and maxima were not reset on extending the analysis to other countries, negative values of e-business readiness might result as countries were included where penetration lagged behind the most laggardly EU15 country. Values in excess of the intended maximum (typically 100) might also occur, causing equal difficulties in interpretation and hence loss of transparency.

Setting goalposts: For the long-term assessment of stable policy targets, stable measures should be used. "Goalposts", the upper and lower bounds for re-scaling of component variables, should be fixed independently of a particular data set. The additional consideration of categorisation led to definition of two quality criteria which it is suggested all eEurope indicators should conform to:

⁶ This section summarises considerations by empirica GmbH, published in the European E-Business Report 2003 [cf. Robinson, 2003].

- Indicator values should be impervious to arbitrary (dis)aggregation operations (e.g. moving from NACE Division to NACE Section, from EU15 to EU15+Candidate States)
- Indicator values should be valid in the sense that movement over time should reliably reflect real movement in underlying e-business readiness

Weighting considerations: It became clear that weighting, as rescaling, should not be derived from empirical values, nor was sensitivity analysis expected to yield appropriate weights. The topic of weighting goes to the root of the meaning of the indicator. It is recommended to pursue weighting through expert assessment, where independently of empirical evidence on penetration, experts were to review the relative contribution of component variables to the competitiveness of enterprises, regions and national economies. Such expert assessment would have to take account of statistical properties of intercorrelation or "double counting", of interaction effects such as complementarity and the impact of boundary-setting on the effective weight of a component variable.

Pointers to future work: The sensitivity analysis of the assumptions made on re-scaling and weighting revealed that the result, at least in terms of cross-sectoral pan-European ranking, was apparently insensitive to these. Reasons for the stability of the ranking became clearer in initial correlational analysis. It turned out that component variables are quite highly intercorrelated across sectors, with correlations between component variables of typically 0.8 and more. These signs of high intercorrelation have great significance for the further development of the enterprise e-business index. It may well be that a large proportion of variance is shared across the component variables. Principal factor analysis has yet to be carried out, but it seems likely that a strong main factor will be found.

One implication of this structure is the prospect is of being able to measure the index in a more cost-effective way: one or more component variables could be dispensed with very little loss in accuracy. The prospect of reducing the component variable set to two or three raises the question, in anticipation of the result, as to whether the indicator properly covers the field intended.

Further work is required to explore the coverage of the indicator compared to that implied by "e-business readiness", and the empirical interrelationship between components judged a priori as part of the concept. In terms of improving cost-effectiveness, not only can the number of variables be reduced within the e-business readiness indicator, but there is every indication that examination of the relationship to other indicators in the eEurope catalogue would lead to a significant focussing of the indicator component set and to potentially much more transparent and cost-effective monitoring of the progress of eEurope policy.

5 Value-added indices – a pilot by the *e-Business W@tch*

The way forward to develop innovative statistics on ICT, electronic business usage and integration may to be found in a pragmatic middle course between presenting a vast amount of single indicators on various aspects of e-business on the one hand, and computing them into (too?) complex compound indices on the other.

Efforts to develop and pilot compound e-business indicators should definitely be continued, as they are helpful to summarise multi-dimensional issues for decision-makers, provide the "big picture", and as they can be easier to interpret (once they are widely accepted) than trying to find a trend in many separate indicators. However, if the aggregate index becomes too complex, it can become difficult to justify them and to argue what they actually stand for.

What could be useful for policy making and evaluation processes, are "value-added indicators" that provide information about a specific area of electronic business usage by computing a few closely related component indicators. In particular, value-added indicators could bundle information about frequencies ("how many enterprises use ...") with information about intensity ("how much do they ...").

In the context of the *e-Business W@tch*, empirica GmbH has piloted a number of such value-added indicators based on data from the two e-Business Surveys carried out in 6/2002 and 3/2003. The method used was to define each of these (simple) indices in a way that they can take a maximum value of 100. However, in most cases 100 constitutes a theoretical value that will probably not be reached any time soon, nor is it necessarily an objective to reach a higher value. The indices are thus more of a descriptive nature than of a normative one. Policy may, of course, decide that an increase in one of these indices is a desirable objective on whatever level (for example for a region, a sector, or for small enterprises). One of the main advantages of using indices which can take a maximum value is that this facilitates monitoring of progress over time.

On the following pages, three of these value-added indices are presented with a brief rationale why this index was computed, its definition and pilot results for 15 sectors of the EU economy (in 2002).

5.1 The E-Sales Intensity Index

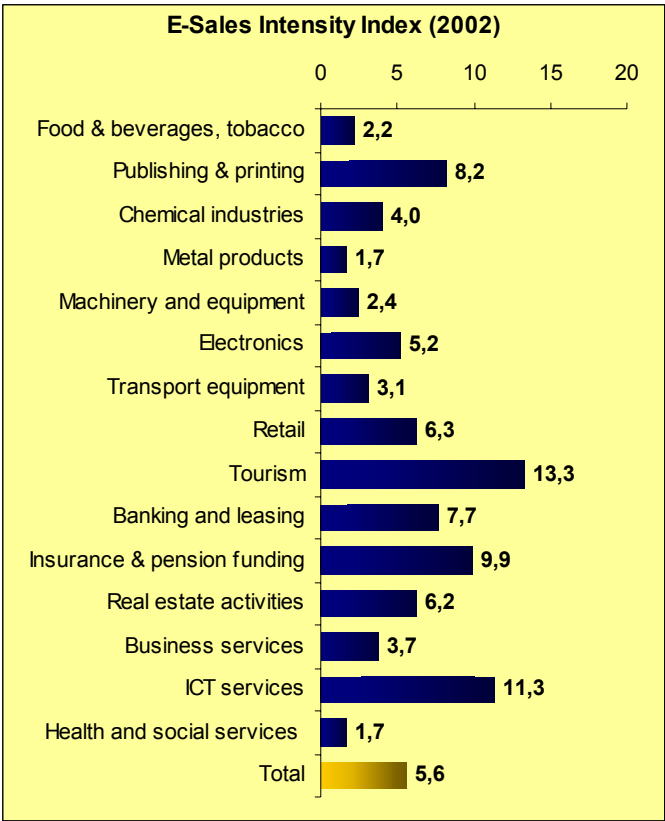
Rationale: The idea behind this index was to combine information about how many companies make online sales with information about the relative importance of these sales (measured as a share of their total sales). The index is based on survey questions whether a company sells their goods or services online, and – if so – about the percentage of goods

and services purchased online. The computed index should facilitate comparisons of the intensity of sell-side e-commerce activities across regions, sectors or enterprise size-classes.

Definition: The share of companies making more than 50% of their total sales online is computed with a weight of 1, of companies selling 26-50% online with a weight of 0.75, 11-25% with a weight of 0.5 and the share of those that sell online, but less than 11%, with a weight of 0.25. In order to adjust for the economically higher importance of large enterprises, the index computes both the employment-weighted and the enterprise-weighted values (according to the formula specified before) and calculates the mean value. The index would take a (theoretical) maximum value of 100 if all companies (from the sector, country etc. for which the index is computed) sell more than 50% of their goods and services online through the internet or another online network.

Results: Results show that typical sell side e-commerce is most intensively used in service sectors catering for a large number of consumers, rather than in manufacturing sectors which sell mainly to other businesses.

In tourism and in ICT services (here defined as telecommunications and computer related services), the share of goods and services sold online is highest. In the financial sectors (banking and insurance), and in publishing and printing, e-commerce has also reached a relatively important dimension, according to this Index.



Comments: Obviously there are drawbacks of the indicator if data are based on assessments rather than hard facts, due to the survey method applied. As in telephone interviews one is restricted to merely one respondent per company (the IT executive in our case) responding at one moment (instead of looking up verified figures and carrying these over to the questionnaire) – unless one is able to bear disproportionately higher survey costs and presumably significantly lower response rates – the researcher has to allow for the level of detail that the interview situation and the responding person permit. Hard figures on total sales and online sales, preferably even as time series data would be more appropriate – but this disregards the likely high shares of item non response.

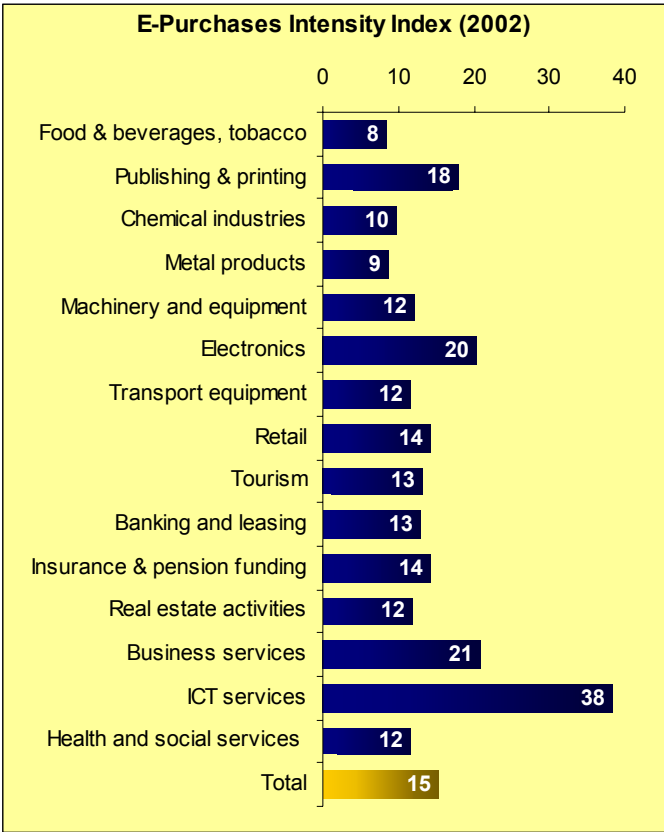
5.2 The E-Purchases Intensity Index

Rationale: Similarly to the concept of the E-Sales Intensity Index, the idea of this index is to combine information about how many companies make online purchases with the intensity of their e-procurement activities. The index is based on survey questions whether a company makes purchases of direct production goods or MRO goods online, and – if so – about the percentage of goods and services purchased online.

Definition: The share of companies procuring more than 50% of their total purchases online is computed with a weight of 1, of companies procuring 26-50% online with a weight of 0.75, 11-25% with a weight of 0.5 and the share of those that procure online, but less than 11%, with a weight of 0.25. In order to adjust for the economically higher importance of large enterprises, the index computes both the employment-weighted and the enterprise-weighted values (according to the formula specified before) and calculates the mean. The index would take a (theoretical) maximum value of 100 if all companies from the class / sector / country for which the index is computed buy more than 50% of supply goods and services online.

Results: The Index values for e-purchasing are higher than the (methodologically comparable) values for online selling. This confirms that B2B e-procurement activities have developed more dynamically than B2C e-commerce, at least in terms of volumes traded.

Differences between sectors are less pronounced than in sell-side e-commerce activities, with the exception of the outstanding index value for the ICT services industry.



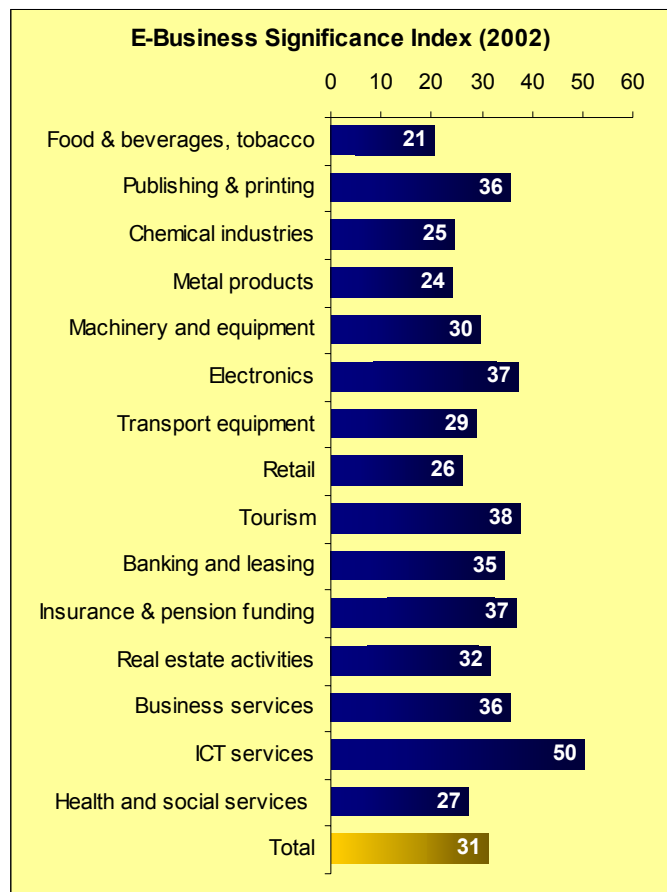
Comments: The same comment applies as above (cf. "E-Sales Intensity Index").

5.3 The E-Significance Index

Rationale: The idea behind this index was to provide a simple instrument for comparing the significance of electronic business in different sectors, regions or size-classes, as perceived by enterprises themselves. As the index is based on the perception of companies and not on objective facts, however, it describes attitude and awareness rather than factual significance.

Definition: Data are based on a survey question. The percentage of companies saying that "e-business constitutes a significant part of the way they operate" is computed with a weight of 1, the percentage of companies saying that "e-business constitutes some part of the way they operate" with a weight of 0.5. The index would take a (theoretical) maximum value of 100 if all companies from the class / sector / country for which the index is computed say that e-business constitutes a significant part. In order to adjust for the economically higher importance of large enterprises, the index computes both the employment-weighted and the enterprise-weighted values (according to the formula specified before) and calculates the mean.

Results: The perception of enterprises how significant e-business has become for their operations reflects very well the more objective findings about the diffusion of ICT and software applications. Sectors which consider e-business as less relevant are mainly those where the "digital divide" between the large and small companies is most pronounced. The chemical industries and transport equipment manufacturing are good examples. In these sectors, large players are among the e-business pioneers, while small enterprises are found to be slow adopters, adhering to traditional production and communication methods.



Comments: This index in particular can easily be challenged on the ground that data are highly subjective, as they are based on the perception of enterprises and not on hard "objective" facts. The index should therefore be considered as a barometer for how

significant companies consider e-business to be, but not as a benchmarking index of factual significance derived from hard facts.

6 Conclusions

At the Lisbon Council in March 2000, the European Union set itself the strategic goal of creating full employment in a competitive and inclusive knowledge-based economy. To reach this goal, the heads of state announced the adoption of a new open method of co-ordination, which is based on benchmarking and spreading best practice. It is in this context that a policy making approach based on concrete objectives and measurable targets has significantly gained momentum. However, while setting realistic, concrete and achievable targets is increasingly acknowledged as an indispensable task for policy making processes, it proves to be probably one of the most difficult challenges for policy makers in the field of electronic business.

This paper explores some of the challenges which researchers, statisticians and policy makers have to tackle in their search for appropriate e-business indicators. It discusses the e-Business Index developed by DG Enterprise for the eEurope 2005 benchmarking indicators, focusing on some of the statistical issues involved when aggregating component indicators into an index. As a conclusion, the paper proposes that "value-added indicators" that provide information about a specific area of electronic business usage by computing a few closely related component indicators may be a viable and practical compromise between creating highly sophisticated indices on the one hand and individual component indicators on the other.

While the discussion on these issues has intensified over the past 18 months, not least because of the large demand from policy, solutions are still scarce. The pilot demonstration in this paper of three such indicators developed by the *e-Business Watch*, based on data from its annual e-Business Survey, should contribute to this debate.

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