
JRC Technical Notes

Streamlining Microdata for the Analysis of ICT, Innovation and Performance

IPTS-IS Unit Methodological Report Series #1

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Preface

This *Technical Note* is the first in a methodological reports series produced by the Information Society Unit at IPTS. This series deals with the development of appropriate tools for analysing the Information Society.

This report portrays the outcomes of the workshop '*Bridging microeconomic data sources for the analysis of ICT, innovation and performance*' on the state of the art in international micro-founded analyses on Information Communication Technologies (ICTs), R&D, innovation, and economic performance.

Micro-level statistics allow us to elicit the internal variability of productive systems. Nonetheless large-scale application of these statistics is still limited for different reasons, mostly related to the availability of information.

Against this background, the workshop provided a broad overview of completed and ongoing analyses. Several proposals were also put forward to address current methodological issues and fully realise the potential of microdata.

This report summarises the experiences and views gathered and shared on these topics.

TABLE OF CONTENTS

Acknowledgements	1
Preface	3
The workshop: who, why, what	7
Analytical results	9
Statistical issues and recommendations	11
Pathways for research: first steps	15
Annex 1: List of participants	17
Annex 2: Workshop agenda	19
Annex 3: Presentations and related projects	21
1. ICT usage behaviour and productivity of enterprises - <i>T. Clayton</i>	21
2. ICT-enabled innovation patterns in enterprises - <i>V. Spiezia</i>	21
3. ICT usage and macroeconomic performance - <i>M. Draca</i>	21
4. Determinants of ICT usage gaps across economies - <i>G. Cetto and J. Lopez</i>	22
5. Methodological issues and hints from the Italian data - <i>G. Perani</i>	22
6. Views on the EU R&D gap with the US in the ICT sector - <i>S. Lindmark</i>	23
7. ICT inventions contribution to invention in non-ICT industries - <i>V. Spiezia</i>	23
8. ICT R&D performed in other sectors: national accounts perspective – <i>G. Turlea</i>	24
9. Analyzing the innovative activity of young businesses: perspectives and difficulties using administrative data - <i>V. Spiezia</i>	24
10. Age of firms and R&D expenditure - <i>A. de Panizza</i>	25
11. R&D and innovation diffusion. Some preliminary insights from the micro-macro linkages - <i>A. Conte</i>	25
12. ICT usage dynamics and indicators from non-official statistics - <i>T. Kretschmer</i>	27
13. ICTs and technological capabilities within a composite indicators' framework - <i>A. Filippetti</i>	27
14. Innovative behaviour, firm performance, and the role of policies - <i>R. Evangelista</i>	28
15. Knowledge, economic performance and policies - <i>A. Brandsma</i>	29

The workshop: who, why, what

This report describes the outcomes of the workshop ‘Bridging microeconomic data sources for the analysis of ICT, innovation and performance’ organised by IPTS¹ on the state of art in international micro-founded analyses on Information Communication Technologies (ICTs), R&D, innovation, and economic performance.

Micro-level statistics allow us to elicit the internal variability of productive systems. For this reason, they can be extremely useful for understanding industry and macro dynamics, as well as for policy design and monitoring. Nonetheless, large-scale application of these statistics is still limited, especially in the field of the knowledge economy for different reasons, mostly related to the availability of information.

Against this background, the workshop aimed to provide a broad overview of completed and ongoing analyses at National, European and OECD levels, and also to share experiences and discuss proposals to address current issues and fully deploy the potential of microdata.

The workshop took place in Seville, on 26-27 February 2009, and was attended by experts from a number of Institutions: the OECD, the Banque de France, European National Statistical Institutes (NSIs), Universities and Research Centres and the European Commission’s Joint Research Centre, the Directorates General for Economic and Financial Affairs (DG ECFIN), and Information Society and Media (DG INFSO), and Eurostat. Participants presented empirical results and ongoing studies, and discussed current issues in research, methodologies, and statistical information.

The studies presented covered the whole techno-economic paradigm related to ICTs, innovation and performance, including: factors determining the intensity and sophistication of ICT usage; its relationships with patterns of innovation and performance at firm and macroeconomic levels; the determinants of the EU-US gap in research and knowledge intensive activities; the role of entrepreneurship, and the capability of firms to grow. To this end, the studies used a number of sources (see Table 1) in different combinations.

Methodological issues addressed in the presentations and debate included: the problems encountered when trying to enhance the potential of bridging micro-sources and possible solutions, interactions with macro data, complementary and non-official statistical sources; measurement of ICT-related activities and R&D across the economy, and the reconciliation of company information to BERD (business expenditure in R&D) statistics; the building of composite indicators and the effectiveness of these, etc.

This report summarises the experiences and views gathered and shared by subject. Individual participant names are mentioned together with a reference number linking them to projects. Annex 1 lists participants and Annex 2 contains the workshop agenda. Projects are listed in Annex 3, along with details of the main features of each.

¹ IPTS (Institute for Prospective Technological Studies) is one of the 7 research institutes of the European Commission’s Joint Research Centre.

Analytical results

Presentations spanned multiple areas, which were very often intertwined, as shown in the matrix of research topics and sources in Table 1.

Overall, the view that **ICT adoption is a driver of growth** in the knowledge economy was supported by empirical analyses carried out across a number of European and other advanced economies on corporate ICT usage, behaviour and performance. These analyses also highlighted that ICT usage is only one element within a techno-economic paradigm, which can be partly mimicked by ICT usage variables. However, this also calls for more thorough consideration. Indeed, empirical analyses suggest that both the intensity and the economic effectiveness of ICT take up depend on the endowment of human resources, complementary investments, industry specificities and the characteristics of the institutional framework. Partial evidence also points to a positive association between ICT usage and (especially non technological) innovation, although linkages with innovation patterns and causality issues are only now being addressed in a comprehensive fashion. The following results from the studies support these views:

- ICT take up across EU countries and the USA is found to be directly related to the spread of tertiary education, and inversely to the relevance of product and labour market regulations (Cette-Lopez). Sophistication and intensity of ICT usage are also generally associated with complementary investment, while their impact is dependent on both co-investments and complementary factors (Clayton [1] for 13 European countries; Draca [3] with respect to regulation and on the explanation of the EU vs. US ICT-related Total Factor Productivity (TFP) gap; Filippetti [13] on ICTs and technological capabilities from a composite indicators' macro perspective).
- There is also evidence of direct linkages of ICT usage measures (such as broadband diffusion and networking) with innovation and non R&D-based knowledge production, suggesting that ICTs enable innovations encompassing the whole business architecture, especially in service activities (Clayton [1]).

Ongoing research: the results from an OECD study, which addresses in a comprehensive manner relationships between ICT usage and innovation patterns (Spiezia [2]).

- ICT usage is found to be directly related to productivity levels, but with important differences across EU countries and sectors (Clayton [1]: in manufacturing, it is commonly associated with higher productivity, but with different intensities across EU countries; in services, countries with highest usage indicators present strong productivity effects, while some country/industry combinations show negative correlations).

Ongoing research: an OECD study, which encompasses ICT usage, human capital, organisation and productivity, by linking microdata on individuals with enterprises economic and technological information (Spiezia [9A-B-C-D]).

The **pervasive role of ICTs in knowledge creation** was also confirmed by available evidence, with implications for innovation and research activity, and also for (knowledge-based) economic and entrepreneurial growth. In more detail:

- When considering inventive activity, patenting in non ICT fields shows a positive correlation to citations of patents in ICT technologies, across industries and over time, while the intensity of ICT-related patent citations and their distribution by technological field differ significantly among countries (Spiezia [7]).

- With respect to R&D, preliminary evidence shows that a sizeable amount of ICT-related R&D is embedded in other industries' BERD (Turlea [8]; this will be the subject of a future IPTS study). ICT sector dynamics are essential to the explanation of the R&D intensity gap between the EU and the USA (especially when we move from BERD to company data: Lindmark [6], and Brandsma [15] on the role of services and the industrial structure), and might also be crucial in understanding the lesser capability of European firms for knowledge-based growth.

Ongoing research: these themes are addressed by a set of OECD studies on entrepreneurship covering patenting activities, market incentives for innovation, the access by new firms to finance and the role of patents in the growth of firms (Spiezia [9]), and by an EU-level pilot study on business demographics and R&D by IPTS, Eurostat and DG INFSO (de Panizza [10]).

The importance of **sector and firm level heterogeneities**, outlined in ICT usage studies, was clearly highlighted in analyses related to **innovation and competition**. In more detail:

- **Competitive pressure** shows no direct effect on returns from product or process innovation, but it **increases the scale of production**, which in turn facilitates **product innovation**. Product and process innovation appear to be substitutes, and firms tend to specialise in one of the two (Draca [5], based on non official statistics)
- Evidence on EU **differences in innovation** patterns with respect to inputs and strategies suggests that these might **mirror diversities in competition models**, selection mechanisms and in the effects of innovation on performance. With specific reference to ICT usage, Italian and Dutch data show that the impact on employment in services varies depending on the underlying innovation strategies of firms (Evangelista, on CIS and economic accounts).

Ongoing research: a DG ECFIN project on the diffusion of innovation, identified cooperation, trade and competition as key channels through which innovation results in durable growth, and is now assessing the role of EU Single Market in promoting the diffusion of innovation. This study adopts a mixed micro- and macro- founded approach, and is complemented by another project which aims to track linkages between market integration and innovation performance, based on comprehensive monitoring of leading European firms (Conte [11D]).

The results and ongoing research in the field of the knowledge economy outlined above illustrate the potential of microdata for industry and macro-level analyses and, especially, for policy design and monitoring. Indeed, only micro-founded analyses allow us to ascertain the relative importance of a number of elements and how they interact in different firms. The deployment of this potential, however, will depend crucially on overcoming issues in data production and accessibility, which are discussed in the next section.

Statistical issues and recommendations

The most general and broad ranging set of issues addressed in the workshop concerned **putting information from different sources together**. Indeed, surveys are designed to portray specific features of enterprise systems by, for example, area, sector, or size, but not to link elementary data collected from other sources. In some cases, design policies for integrated business statistics pursue the reduction of statistical burden for respondents by excluding enterprises from selection more than once in multiple surveys.

Experience at the international level shows that the resulting **reduction in joint-sample size** is usually reflected in **strong selection bias** (typically, overweighting larger units) that require specific treatment (notably, reweighting procedures). In some cases, the reduction is such that it prejudices representativeness altogether, or reduces the number of available variables in multi-country analyses. Constraints to comparability and lack of suitable details could also result in differences in measurement, e.g. of ICT impacts, which might stem more from the limitations of the data than the real world (Clayton on skills in the EU ICT impact project, and Spiezia on ICT-enabled innovation).

A complementary issue is that of **providing access to information**, within the European Statistical System and to the research community at large, as only a few microdata from official statistics can be disclosed to third parties on grounds of confidentiality. Finally, the rise and pervasiveness of ICTs, and the fragmentation and internationalisation of production and value chains have brought about **fast changes in information needs**, which represent a major challenge for statistics.

These issues indicate the need for the **streamlining of microdata in official statistics**, by explicitly recommending **joint survey representativeness** (R&D, ICT, CIS, SBS), and other technical devices in survey design, such as rotating panels. **Extending the usage of administrative sources**, a further **investment in meta- and in mesodata production** (e.g. with information on enterprises grouped by quantiles with respect to a given dimension), and provisions concerning **exchange and disclosure of microdata** are also suggested. This would enlarge information potential, reduce statistical burdens, enhance comparability and broaden access to information for research purposes. With specific reference to knowledge economy dynamics, suggestions include the **enlargement and harmonisation of information collection** for some key variables, e.g. capital stock and human resources, and a more frequent and intense communication between official statistics and other (private) sources, to enlarge coverage to some domains which are not (and will not) be directly addressed by NSIs (e.g. ISP for internet traffic; or specialised firms for detailed information on ICT investments by type, motivation, etc.), while ensuring quality standards.

Challenges to comparability also arise from the multiplicity of **classification and data collection systems** for products and activities (at both national and international levels). For example, patents are classified by technologies (IPC), but activities are classified according to industries (ISIC); as a result, it is not possible to establish a one-to-one relationship between them. The matching between manufacturing industries and technological fields has to be based on the actual industry, rather than a concordance (some tentative concordance tables between IPC and ISIC already exist). Linking the obtained results to the OECD STAN database could allow us to assess the impact of ICT-intensive patents on growth and productivity (Spiezia, on ICT patents).

Revisions in classifications, which lead to new aggregations of elementary units, might increase comparability issues, but also provide opportunities for a better tracking of techno-economic dynamics. An example of particular relevance for the specific case of ICT activities is the present transition to NACE rev.2, with the creation of the new section 'J' for information and communication and the general trend towards splitting computer services (division 72 in Rev1.1) into several classes (Perani on Italian R&D microdata). Though this creates some difficulties and calls for a bridging effort in aggregate statistics, Rev.2 also seems to provide an opportunity to better focus on the finalisation of R&D to ICT applications, In particular, this applies to the case of ICT services, which are still difficult to track, notwithstanding the inclusion of innovative software development in R&D activities by the Frascati Manual 2002.

Adopting classification-related recommendations might also be of great help in overcoming the above issues. This is the case, in particular, of the **product field** approach (together with the main activity) recommended by Frascati 2002 for R&D surveys, that would allow for a significant improvement in comparability with other economic statistics. Similarly, the new and finer **by field of science** taxonomy might help to disentangle industry-related dynamics for different components of R&D.

Bridging sources on business R&D would greatly improve understanding. Indeed, BERD information is collected at the level of institutions in order to show overall R&D investment, and no reference is made to specific R&D activities and projects, or to the outcomes of the R&D process. Some of these aspects might be available from company reports. However, bridging these two sources faces **issues of different types**, such as:

- Lack of homogeneity of concepts: BERD refers to R&D performed in a given country, while company information refers to company investment, irrespective of the country of performance; different reporting units for multi-plant and multi-enterprises cases;
- A still low level of standardisation of company reports,
- A likely lower representation of SMEs (reluctant to disseminate information), and
- The overall poor comparability of qualitative information (e.g. ICT use).

Some improvements might be achieved through changes in accounting standards (at present, R&D investment is aggregated with other costs). Additionally, if the evidence presented by Perani on Italy is confirmed and bearing in mind the growing number of countries with tax credit schemes for R&D activities, administrative (fiscal) information could be used. This would depend on fiscal records being made accessible to NSIs.

Statistical challenges **for the analysis of embedded ICT systems** are similar to those posed by the **internationalisation of production and research** as in both cases, **the entire value chain has to be followed**. This calls for improvements, and a more extensive usage, of Input-Output tables. With specific reference to embedded ICT (hardware and especially software), additional issues are determined by accounting rules (capital versus intermediate consumption), which might require some reclassifications.

Business registers constitute the backbone of official business statistics, and a key tool for record linkage across different surveys. Notwithstanding relevant (and ongoing) improvements in quality, coverage and harmonisation of business registers, the appropriate tracking of demographic events is still an issue (e.g. when a firm changes of ownership or legal status, it can be erroneously recorded as a "new" firm). This might hamper studies on entrepreneurship, technology and life trajectory of firms. However, by

highlighting the problem, these studies also provide useful feedback to business registers (Spiezia, de Panizza).

Pathways for research: first steps

A snapshot of policy needs and research questions for the near future raises several issues which cut across the fields debated:

- With respect to ICT adoption there are many open questions, including topics such as the distribution of cross country differences (long tails), or the impact of multinationals and of structural features on ICT demand behaviour.
- As regards the role of ICTs in the knowledge economy, some studies (including ongoing works, not presented at the workshop) call for a more thorough understanding of "ICT-based" business architecture and the ways technology take up impacts innovation and business models alike, while others look at the mix of complementary aspects (outside ICTs) that can influence these effects.
- The analysis of the effectiveness of R&D incentives and of the role of R&D in the diffusion of innovation across economies is also of particular and immediate relevance for policy making.
- Challenges and issues posed by globalisation are on the agenda too, including the development of appropriate tools to tackle the blurring of enterprise and country economic boundaries, and the internationalisation of R&D activities.
- Last but not least, the availability of adequate information is crucial to all the above. Policy needs would be better served by more detailed investigation of territorial and industry level dynamics, and systematic policy impact analysis.

Annex 1: List of Participants

Bogdanowicz, Marc	<i>JRC, IPTS, European Commission</i>
Brandsma, Andries	<i>JRC, IPTS, European Commission</i>
Cetin, Dilek	<i>JRC, IPTS, European Commission</i>
Cette, Gilbert	<i>Banque de France</i>
Cincera, Michele	<i>JRC, IPTS, European Commission</i>
Clayton, Tony	<i>Statistics UK (ONS)</i>
Conte, Andrea	<i>DG ECFIN, European Commission</i>
Cozza, Claudio	<i>JRC, IPTS, European Commission</i>
Damaskopoulos, Takis	<i>European Institute of Interdisciplinary Research - EIIR</i>
de Panizza, Andrea	<i>JRC, IPTS, European Commission</i>
de Prato, Giuditta	<i>JRC, IPTS, European Commission</i>
Desruelle, Paul	<i>JRC, IPTS, European Commission</i>
Draca, Mirko	<i>London School of Economics</i>
Evangelista, Rinaldo	<i>University of Camerino</i>
Filippetti, Andrea	<i>University of Rome La Sapienza</i>
Hagsten, Eva	<i>Statistics Sweden (SCB)</i>
Hernandez, Hector	<i>JRC, IPTS, European Commission</i>
Kretschmer, Tobias	<i>Institute for Communication Economics (ICE)</i>
Lindmark, Sven	<i>JRC, IPTS, European Commission</i>
Lopez, Jimmy	<i>Banque de France</i>
Perani, Giulio	<i>Statistics Italy (ISTAT)</i>
Picci, Lucio	<i>JRC, IPTS, European Commission</i>
Spiezia, Vincenzo	<i>OECD</i>
Stekke, Alain	<i>DG INFSO, European Commission</i>
Tubke, Alexander	<i>JRC, IPTS, European Commission</i>
Turlea, Geomina	<i>JRC, IPTS, European Commission</i>
Wirthmann, Albrecht	<i>Eurostat, European Commission</i>

Annex 2: Workshop Agenda

Thursday, 26 February: *The state of art*

Aims of the meeting and presentation of agenda and participants *M. Bogdanowicz (IPTS)*

Initial framework for methodological and research issues *A. de Panizza (IPTS)*

Corporate ICT usage, behaviour and performance

A. de Panizza (IPTS) Coordination and wrapping-up of session

ICT usage behaviour and productivity of enterprises *T. Clayton (ONS)*

ICT enabled innovation patterns in enterprises *V. Spiezia (OECD)*

ICT usage and macroeconomic performance *M. Draca (LSE)*

Determinants of ICT usage gaps across economies *G. Cetto –J. Lopez (B. de France)*

(ICT) R&D: enterprise vs. national and technological perspectives

A. Brandsma (IPTS) Coordination and wrapping-up of session

Bridging company R&D investment with BERD type national data

Methodological issues and hints from the Italian data *G. Perani (ISTAT)*

Views on the EU R&D gap with the US in the ICT sector *S. Lindmark (IPTS)*

Technology and Sector of performance (Embedded systems)

ICT inventions contribution to invention in non-ICT industries *V. Spiezia (OECD)*

ICT R&D performed in other sectors: National Accounts perspective *G. Turlea (IPTS)*

ICT R&D and NACE classifications: a survey perspective *G. Perani (ISTAT)*

Complementary dimensions and indicators

E. Hagsten (Statistics Sweden) Coordination and wrapping-up of session

Innovation and entrepreneurship: age, inventive performance & economic trajectory of firms *V. Spiezia (OECD)*

Age of firms and R&D expenditure *A. de Panizza (IPTS)*

R&D and Innovation Diffusion. Some preliminary insights from the micro-macro linkages *A. Conte (DG ECFIN)*

ICT usage dynamics and indicators from non-official statistics *T. Kretschmer (U. of Munich)*

ICTs and technological capabilities within a composite indicators' framework *A. Filippetti (U. of Rome)*

Friday, 27 February: *Needs and opportunities for future research*

Summary of the first day outcomes (IPTS) – debate and validation

Bridging research and policy perspectives on emerging issues

Innovative behaviour, firm performance, and the role of policies *R. Evangelista (U. of Camerino)*

Knowledge, economic performance and policies *A. Brandsma (IPTS)*

Open discussion

Wrapping up – next steps

Annex 3: Presentations and related projects

1. ICT usage behaviour and productivity of enterprises - *T. Clayton*

Project name	ICT impact on productivity/growth assessment by linking data across countries and sources
Coverage	13 (9+4) EU Countries, 2000-2005
Participants	13 EU NSIs, led by UK Office for National Statistics
Sources	National Accounts, Production Surveys, ICT usage surveys, balance sheets, other data for specific analyses at the national level.
Aims	Linking data sources to identify how ICT adoption affects business behaviour and performance. The focus shifts from firm level analysis at national level to cross-country industry level analysis.
Results	Evidences show that ICT is involved in innovation: ICT networks support ‘knowledge production’; ICT intensity changes the degree of competitive innovation, ICT helps marketing new products and often coincides with the innovation itself. Nevertheless, ICT interacts with complementary factors. A need for a change in the statistical systems comes from the potential represented by a coordinated micro – macro approach.
Report	http://circa.europa.eu/Public/irc/dsis/emisannexes/library?l=/data_-_database/theme_3_-_popul/isoc/reports/491022005017-2006128/_EN_1.0_&a=d

2. ICT-enabled innovation patterns in enterprises - *V. Spiezia*

Project name	ICT-enabled innovation
Coverage	15 Countries
Participants	A network of national researchers from 11 EU countries + Australia, Canada & New Zealand + ITPS Seville
Sources	Joint ICT-Innovation sample: ICT Usage Survey, CIS.
Aims	Testing if ICT usage in firms causes higher probability to innovate and/or specific features of innovation.
Results	Ongoing.

3. ICT usage and macroeconomic performance - *M. Draca*

Project name	ICT usage and macroeconomic performance
Coverage	20, 1998-2008
Participants	LSE Centre for Economic Performance
Sources	AMATECH = Harte-Hanks CiTDB ICT data, matched to AMADUES and additional datasets: AMAPAT (Patents dataset), IMS, Eurostat R&D Scoreboard, industry-level data (KLEMS, OECD), Comtrade, Prodcom.
Aims	Microeconomic perspectives on ICT adoption and productivity, trade, competition, regulation and multinationals
Results	Insight into factors determining ICT diffusion, and the diffusion gaps against the US. Compared to US, lower ICT diffusion in the other major advanced countries could be explained by a smaller share of the population with a higher education and/or a higher level of rigidity in labour and product markets. IT changes informational flow, changing the optimal firm structure, so that full potential of ICT can be exploited if reorganisation is allowed.

4. Determinants of ICT usage gaps across economies - *G. Cetto and J. Lopez*

Project name	ICT demand behaviour: an international comparison
Coverage	11 OECD Countries, 1970-2005
Participants	Banque de France & Université de la Méditerranée
Sources	EU-KLEMS database; Tertiary education (Cohen & Soto, 2007); Labour Market Regulation (OECD Employment Protection Legislation - EPL); Product Market Regulation (OECD Energy, Transport & Com. Regulation - ETCR).
Aims	Empirical investigations to explain the gaps in ICT diffusion: how structural variables affects ICT demand behaviour. The role of multinationals in determining cross-country differences in ICT-using sectors. ICT and Knowledge Capital: ICT's role in assisting innovation activities as R&D and patenting; ICT capital and other knowledge capital. Role of Institutions and Policy: impact of labour and product market regulation on ICT usage. Role of trade in affecting ICT adoption; distribution of activities across countries.
Results	Changes in the structural variables impact on ICT Diffusion. The ICT Price-Elasticity is evolving along time, showing a slowdown in the widening of the ICT diffusion. The impacts of education (positive) and of regulations (negative) are growing with the level of ICT already reached.

5. Methodological issues and hints from the Italian data - *G. Perani*

Project name	Research Unioncamere 2006 on SMEs R&D reporting (5A)
Coverage	Italy, 2004
Participants	Italian Union of the Chambers of Commerce (Unioncamere), Istat
Sources	National Accounts, Balance Sheets Data, Company Reports.
Aims	International Accounting Standards do not allow for a detailed reporting of R&D expenditures by business enterprises. The Balance Sheets Explanatory Notes can in some cases provide detailed R&D data. R&D activities are often reported in Company Reports too, but accessing such information is limited by matching issues.
Results	The balance sheets explanatory notes of some thousand SMEs in four Italian regions have been checked. BERD data need to be benchmarked against other sources of information on R&D to detail information on R&D activities and investments by business enterprises. An improvement could come from the implementation of national/international registers of R&D performers (at least the largest ones) in order to collect all available information on those enterprises performing R&D on a systematic way, and from the development of new statistical activities – even outside the NSIs – to get more “qualitative” information on the R&D performed in the private and in the public sector.

Project name BERD and Data micro-linking - BERD and company reports: the IPTS Scoreboard (5B)

Coverage Italy, 2006

Participants ISTAT, IPTS

Sources National Accounts, CIS, R&D survey, Company Reports.

Aims Business Enterprises R&D data produced on the basis of the Frascati Manual guidelines (BERD) can potentially be linked to several sources. Analysis of Company Reports of Italian CIS Companies to detail R&D expenditure.

Results R&D expenditure computation based on Company Reports details on R&D.

6. Views on the EU R&D gap with the US in the ICT sector - S. Lindmark (IPTS)

Project name PREDICT - Monitor and analyze ICT R&D activities in the EU

Coverage EU27

Participants IPTS Seville

Sources National Accounts, EU Industrial R&D Scoreboard, SBS.

Aims Perspectives on the EU-US ICT sector R&D gap. Analysis of differences of macro and micro business R&D data.

Results Macro findings: The EU-US R&D gap is mainly (about half) an ICT sector R&D gap. Higher RDI in the US is the main explanation for the gap. The size (weight) of the sector less an explanation. EU and US ICT sectors show similar composition but different R&D intensities in selected sub-sectors. Micro findings: The company ICT sector R&D gap is bigger than the overall R&D gap. The company R&D gap with the US is “fully” an ICT R&D gap. RDI is similar (for sub-sectors). Size (weight) of the sector is the main explanation for the gap. Composition of sub-sectors differs. Similar R&D intensities at sub-sector level, but sector is much larger in the US .

7. ICT inventions contribution to invention in non-ICT industries - V. Spiezia

Project name Using Patent Citations to Measure the Contribution of ICT Inventions to Inventive Activities in Manufacturing: an Exploration

Coverage OECD Countries, 1985-2005

Participants OECD

Sources OECD/EPO dataset of patent citation.

Aims Analysis of the intensity of ICT citations in OECD patents over the period 1985-2005, to examine the contribution of ICT inventions to the overall invention in manufacturing, considering patents as a measure of invention, and citation as a measure of the contribution of previous knowledge to invention.

Results The intensity of ICT citations differs significantly among countries. In Finland, it was almost double than the OECD average. It was also very high in Korea, the Netherland and Japan. The distribution of ICT citations by technological field also differs among countries. A regression analysis shows that ICT inventions matters across industries and overtime.

8. ICT R&D performed in other sectors: national accounts perspective – G. Turlea (IPTS)

Project name	COMPLETE - Embedded Software, Automotive sector
Coverage	EU27
Participants	IPTS Seville
Sources	maximum use possible of existing data and statistical framework, also allowing bridging with business intelligence data.
Aims	To propose a methodology able to provide data on both production and diffusion of embedded systems. Data must be internationally comparable, and easy to integrate with other measurement frameworks used in policy making. The proposed methodology is meant to be relatively easy to apply, repeatable and also allowing bridging with business intelligence data.
Results	Ongoing. Being embedded systems built as a dedicated functionality consisting of ICT/electronic (hardware) components and software, two main statistical implications are connected to the analysis of embedded systems themselves: the entire value chain has to be followed to carry out such an analysis, and ICT/electronic (hardware) components (and part of the bought software) are to be considered as intermediate consumption, while customised software (and part of bought software) is capital.

9. Analysing the innovative activity of young businesses: perspectives and difficulties using administrative data - V. Spiezia

Project name	OECD/WPIA Projects about Entrepreneurship and the Growth of New Firms - The inventing and patenting activities of new firms (9A)
Coverage	6+5 OECD Countries
Participants	OECD
Sources	A longitudinal database including new ventures since their birth. Patents; Business Registers; firm level survey data.
Aims	The project deals with a new thematic by using new data, through an effort of harmonisation of administrative data across OECD countries. In order to analyse innovation indicators, patents are taken as benchmark. Description of population of patenting firms by firm age, of patenting behaviour of young firms, of patenting propensities across age bands. and taking account of financing conditions. Impact of patenting on the firm's further development. Analysis of patenting in the firm's life cycle.
Results	Ongoing. Harmonized use of administrative data; matching of patent data with Business Registers. Distribution of patent filings by age of firms (common 3 years across countries, over specified age bands). By age distribution of patenting firms. Cross-sectional and longitudinal descriptive statistics.

Project name	OECD/WPIA Projects about Entrepreneurship and the Growth of New Firms - Specificities of the financing structure of new firms (9B)
Coverage	6+5 OECD Countries
Participants	OECD
Sources	A longitudinal database including new ventures since their birth. Business registers; balance sheets; firm level survey data; VC data.
Aims	Specificities of the financing structure of new firms
Results	Ongoing. Specificities of the financing structure of new firms. Harmonised use of administrative data.

Project name OECD/WPIA microdata Projects - Market incentives to innovation (9C)

Coverage	8 OECD Countries
Participants	OECD
Sources	Firm-level balance sheet data (SBS microdata); firm-level R&D data (R&D surveys).
Aims	Economic analysis of the impact of competition on firm-level innovative effort (R&D, patents, CIS type of indicators).
Results	Ongoing. Harmonized firm-level analysis across OECD countries. Firm-level balance sheet data matched with firm-level R&D data. Computation of indicators of competition (in particular "Boone" type of indicators, to be compared to price-cost margins type of indicators); analysis of partial correlations with firm level indicator of innovation (R&D as a benchmark), then more structural analysis.

Project name OECD/WPIA microdata Projects - ICT, human capital, organisation and productivity (9D)

Coverage	2 OECD Countries
Participants	OECD
Sources	Linking individuals data (education level and orientation, income, sex and age) to firm level/balance sheet data (sales, capital book value, value added, labour productivity, multifactor productivity) and Complementary (CIS-surveys, E-business surveys, R&D surveys, patent data and trade statistics).
Aims	Verify if investment in public education improves productivity and growth in the business sector.
Results	Ongoing. Harmonised analysis across OECD countries.

10. Age of firms and R&D expenditure - A. de Panizza (IPTS)

Project name R&D and Age of Firms

Coverage	
Participants	EC (ESTAT-INFISO-IPTS), joint work with 6 NSIs
Sources	R&D surveys, Business Registers, SBS.
Aims	Investigating the nexus of business demography with economic performance and R&D activities of enterprises addresses an area of potential concern for policymakers.
Results	Ongoing. EU, national, industry level & time patterns.

11. R&D and innovation diffusion. Some preliminary insights from the micro-macro linkages - A. Conte (DG ECFIN)

Project name GERD by Sectors of Performance of Funds at the EU27 – 2006 (11A)

Coverage	EU27, 2006
Participants	LIME group and WGQPF; Micro-Macro Task Force
Sources	National Accounts, Additional Business data, Patent data.
Aims	GERD by Sectors of Performance of Funds at the EU27 - 2006
Results	GERD by Sectors of Performance of Funds at the EU27 - 2006

Project name R&D spending and efficiency levels (11B)
Coverage EU27, 2001-2006
Participants LIME group and WGQPF; Micro-Macro Task Force
Sources Panel data, questionnaires to Member States on their R&D systems.
Aims R&D spending and efficiency levels.
Results R&D spending and efficiency levels.

Project name MICREF (11C)
Coverage EU27, 2005-2007
Participants LIME group and WGQPF; Micro-Macro Task Force
Sources CIS + MICREF data.
Aims MICREF database, and a suitable methodology to assess Lisbon related structural reforms: provision of yearly EU-wide data, addition of qualitative information on specific reform measures (budgetary impacts, monitoring, policy package, timing), inclusion of knowledge-based economy measures, with a focus on changes in the institutional environment.
Results Evolution of share of reform measures across broad policy fields (average number of registered reform measures varies across Member States). Reform profiles by broad policy domains EU-wide.

Project name Diffusion of Innovation in the Internal Market (11D)
Coverage 22 EU Countries
Participants LIME group and WGQPF; Micro-Macro Task Force
Sources CIS + firm level and sector level data.
Aims Diffusion of Innovation in the Internal Market: towards a more comprehensive approach to Technological Change. Identification of the major channels to transform innovation into prolonged economic growth; identification of the role of the Single Market in promoting Innovation diffusion.
Results Focus on innovation adoption. Cooperation, Trade, Competition as identified channels. Macro data rescaled based on Micro evidence / CIS truncation. Product and process innovation developed mainly together or mainly by other enterprises and institutions.

Project name Market integration and Technological Leadership in Europe (11E)
Coverage EU27
Participants LIME group and WGQPF; Micro-Macro Task Force
Sources Firm level dataset complemented by indicators of industry structure, technological diversification and geographical agglomeration of industries.
Aims To track linkages between market integration and innovation performance by focusing on European leading firms. To provide information on production / employment / technology structure and geographical distribution of leading EU firms.
Results Panel data estimation to explore causal relationship between technological leadership and market leadership.

12. ICT usage dynamics and indicators from non-official statistics - T. Kretschmer (U. of Munich)

Project name ICT Usage Dynamics and Indicators from Non-official Statistics

Coverage 20 Countries, 6 Countries

Participants LMU Muenchen, Institute for Communication Economics

Sources Harte-Hanks CiTDB Market Intelligence & ICT data.

Aims ICT diffusion dynamics. Descriptive statistics on ICT usage dynamics. Non-standardisation of Software technologies: Software is a part of composite goods/systems, thus adoption studies of single Software applications are bound to be imprecise.

Results Case Study on French vehicles market dealers 2000-2004 and European car dealer market regulation, investigating complementarities in Software applications, and whether competition is affecting innovations adoption. Results show that increased competitive pressure has no direct effect on returns to product or process innovation. However, competitive pressure increases the scale of production, which in turn facilitates product innovation. Product and process innovation appear to be substitutes, and firms tend to specialize on one of the two. Ignoring the interdependencies between innovation and scale would have found no effect of competition on innovation. Treating scale as exogenous would have found strong direct effect of competition on (product) innovation.

13. ICTs and technological capabilities within a composite indicators' framework - A. Filippetti (U. of Rome)

Project name The New Global Innovation Scoreboard (GIS) 2008

Coverage 48 Countries, 1995 and 2005

Participants Researchers, University of Rome (IT)

Sources The New Global Innovation Scoreboard (GIS) 2008.

Aims An application of composite indicator methodology, to investigate the role of ICTs for 48 countries (through application of the GIS index for 1995 and 2005).

Results ICT investments are positively correlated with the main economic indicator and innovative performance. A clear process of convergence took place over the last decade. Composite indicators can be useful: to make cross-country comparisons; to explore over time dynamics; to investigate different structures' evolution of the countries; to point out the importance of a specific factor (i.e. ICTs) regarding the innovative performance.

14. Innovative behaviour, firm performance, and the role of policies - R. Evangelista (U. of Camerino)

Project name Innovative behaviour, firm performance, and the role of policies

Coverage Countries covered by CIS 2, 3, and 4

Participants Researchers, University of Camerino (IT)

Sources CIS + Balance Sheets. CIS + Business Register.

Aims CIS data to be exploited to investigate key dimensions of innovation (extent, nature, locus, determinants), the role in shaping competition models and selection mechanisms (in industries / contexts), the effects on aggregate performances (industry level / macro level). CIS indicators analysis for the evaluation of innovation policies.

Results Based on evidences underlining the heterogeneous nature of innovation and the need for specific models able to capture such a differentiation, at least two models of innovation strategies emerging from sectoral studies are identified. Firm level studies based on CIS data merged with balance sheet data confirms the need to explore nature and sources of variety in innovation, disentangling the role of NSI, Regions, Sectors, Firm size, Firm specific factors, for estimating the impact of innovation on the economy as well as for designing more effective/selective policies.

Analysis on innovation and economic performance extended to non-technological innovation to investigate the employment impact of innovation: Results on the effects of innovation policy in Italy and NL. A comparison of innovation policies in Italy and NL shows they had: low impact (more on the inputs than on the outputs side); short term rather than long-term effects; very limited additionality; low structural/long term effectiveness on firms' behaviours and strategies, and apparently no upgrading of the overall innovation profile of the industrial system.

15. Knowledge, economic performance and policies - A. Brandsma (IPTS)

Project name Innovation, ICTs and employment in services. Innovation and economic performances in services.

Coverage

Participants Knowledge for Growth (KfG) Unit, JRC-IPTS Seville; Industrial Research & Innovation, JRC, EC

Sources Official statistics (Anberd),

Aims A sector-specific analysis of R&D investment to better understanding structural growth handicap, the challenges the EU is facing and the goals behind the Lisbon strategy. Even if with lower R&D, services are now the largest part of the economy. According to official statistics the share of R&D expenditure accounted for by the services sector is much higher in the US than in the EU, so services represent the bulk of the EU –US R&D spending gap, and therefore a key to the explanation of the gap itself.

Results Investigation of R&D and innovation in Services and R&D and growth: dynamics, to provide an explanation to the EU-US R&D expenditure gap. The overall level of R&D intensity is largely pre-determined by the structure of the EU economy, while individual EU companies perform as much R&D as their competitors. They should not be encouraged to over-invest. Big R&D investors have a global orientation; their investment in research can only be targeted by co-ordinated efforts across Member States. EU companies, including SMEs, by making efficient use of R&D benefit from the diffusion and exploitation of research findings even if they carry little quantitative weight.

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Abstract

This report portrays the outcomes of the workshop ‘Bridging Microeconomic Data Sources for the Analysis of ICT, Innovation and Performance’ organised by IPTS on the state of the art in international micro-founded analyses on Information Communication Technologies (ICTs), R&D, innovation, and economic performance.

Micro-level statistics allow us to elicit the internal variability of productive systems. For this reason, they can be extremely useful for understanding industry and macro dynamics, as well as for policy design and monitoring. Nonetheless, large-scale application of these statistics is still limited for different reasons, mostly related to the availability of information.

Against this background, the workshop aimed to provide a broad overview of completed and ongoing analyses at national, European and OECD levels, and also to share experiences and discuss proposals to address current issues and fully deploy the potential of microdata.

The studies presented covered the whole techno-economic paradigm related to ICTs, innovation and performance, including: factors determining the intensity and sophistication of ICT usage; its relationships with patterns of innovation and performance at firm and macroeconomic levels; the determinants of the EU-US gap in research and knowledge intensive activities; the role of entrepreneurship, and the capability of firms to grow. To this end, the studies used a number of sources in different combinations.

Methodological issues addressed in the presentations and debate included: problems encountered when trying to enhance the potential of bridging micro-sources and possible solutions, interactions with macrodata, complementary and non-official statistical sources; measurement of ICT-related activities and R&D across the economy, and the reconciliation of company information to BERD (business expenditure in R&D) statistics; the building of composite indicators and their effectiveness, etc.

The report summarises experiences and views gathered and shared on these topics.

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