Socio-Economic evaluation on the E-Infrastructure : Why and how to implement it?

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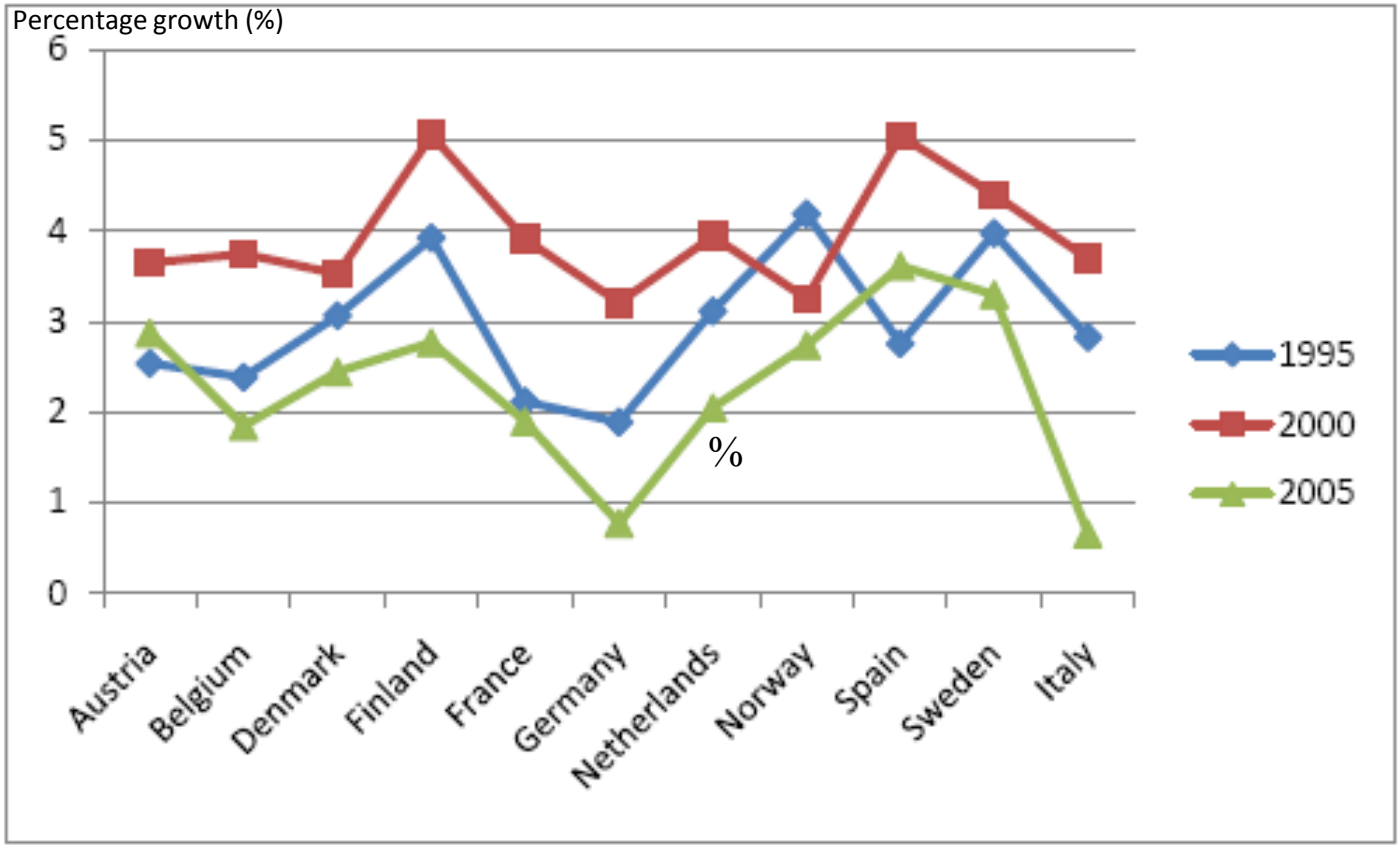
Problem Area

- The Lisbon Strategy, which also the so called the Lisbon Agenda or Lisbon Process was the development plan for the European countries implemented during the period between 2000 and 2010.
- The aim of the agenda was at achieving the EU as "the most competitive and dynamic knowledge-based economy in the world that capable of sustaining the economic growth enhanced by more and better jobs and greater social cohesion", by 2010.
- It was set out by the European Council in Lisbon in March 2000 and by 2010 most of its goals were not achieved

  (see Tabellini and Wyplosz 2004, 2006, 2010)

Problem Area



Source: the World Bank

Contribution of knowledge economy

Percentage contribution

No	Variables	European Union	
		1980-1995	1995-2004
1	Market economy output (2)+(3)	1.8	2.2
2	Hours worked	-0.6	0.7
3	Labour productivity	2.4	1.5
	Composition		
4	Labour composition	0.3	0.2
5	Capital services per hour	1.2	1
6	ICT capital per hour	0.4	0.5
7	Non-ICT capital per hour	0.8	0.5
8	Multi-factor productivity	0.9	0.3
	Contribution of the knowledge economy to labour productivity	1.6	1.1

Source: Van Ark, Mahoney and Timmer (2008)

The ICT Sector[1] and its impact within Europe and the USA

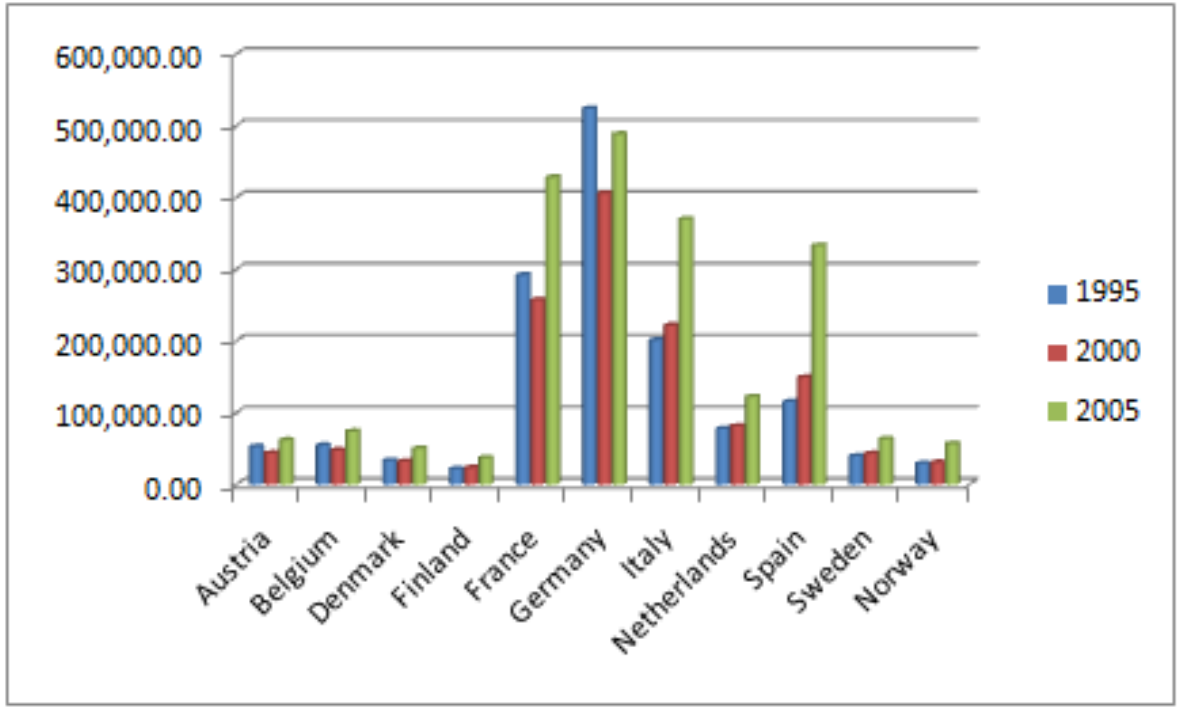
	EU	USA
1. Size (% of the economy)		
1995-1999	5.2%	7.2%
2000-2003	5.6%	7.2%
2. Growth (real terms)		
2000-2003	5.3%	4.6%
3. Market Revenue growth (nominal terms)		
2004	3.8%	3.9%
2005 *estimate*		
Total ICT Sector	3.6%	3.9%
Communications	3.1%	2.8%
IT	4.1%	4.6%
4. ICT Research and Development		
%all research expenditure	25%	35%
% GDP	0.31%	0.63%

		EU	USA
5. Take-up of ICT by businesses			
% of enterprises integrating systems with			
suppliers		10.2%	15%
customers		9.3%	17%
6. Investment in ICT			
As % of GDP		2.4%	4.2%
7. Labour Productivity			
1995-1999	Total	1.8%	2.3%
of which:	ICT	0.9%	1.7%
	Non-ICT	0.9%	0.6%
2000-2004	Total	1.1%	2.8%
of which:	ICT	0.5%	0.9%
	Non-ICT	0.5%	1.9%

8. Innovation by businesses	EU
ICT-enabled product/services	17%
Non-ICT-enabled product/services	29%
ICT enabled processes	33%
Non-ICT-enabled processes	12%

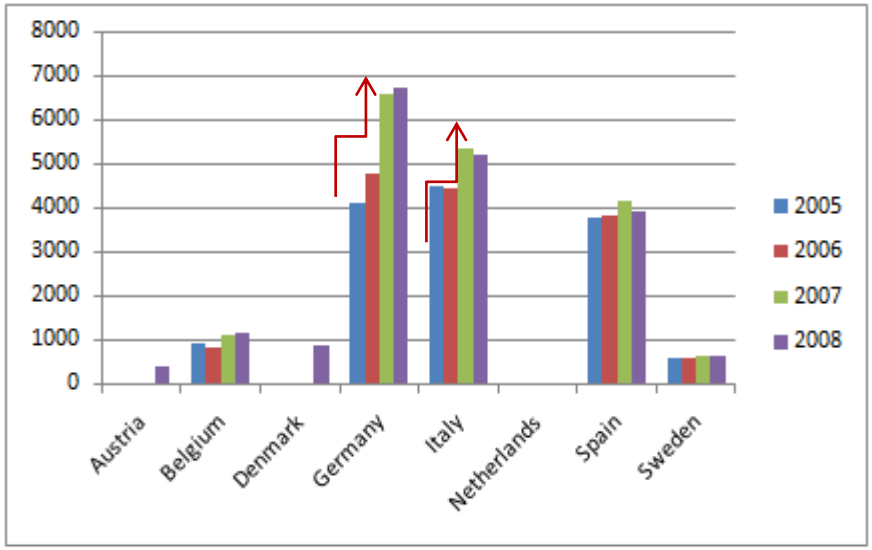
Source: European Commission

Capital investment in the Europe

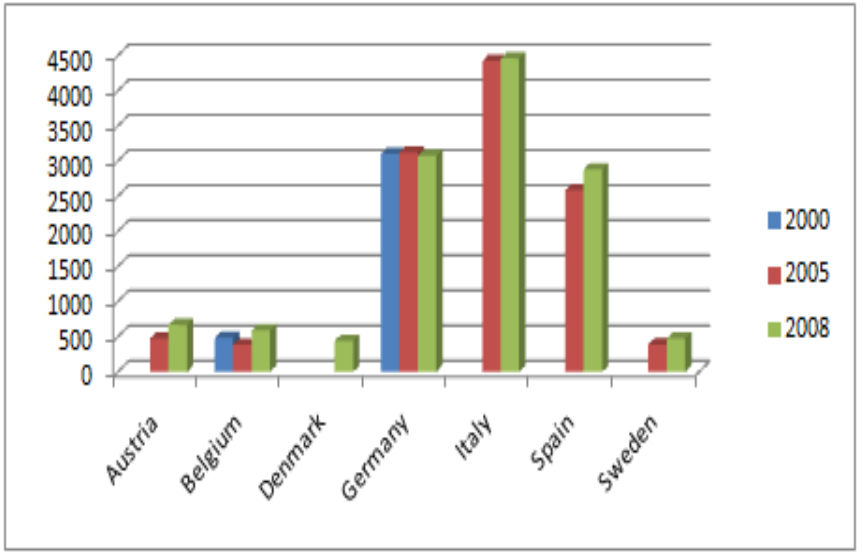


Source: ITU (2009)
Gross fixed capital formation (MUS$)

Investment in the telecommunication sector

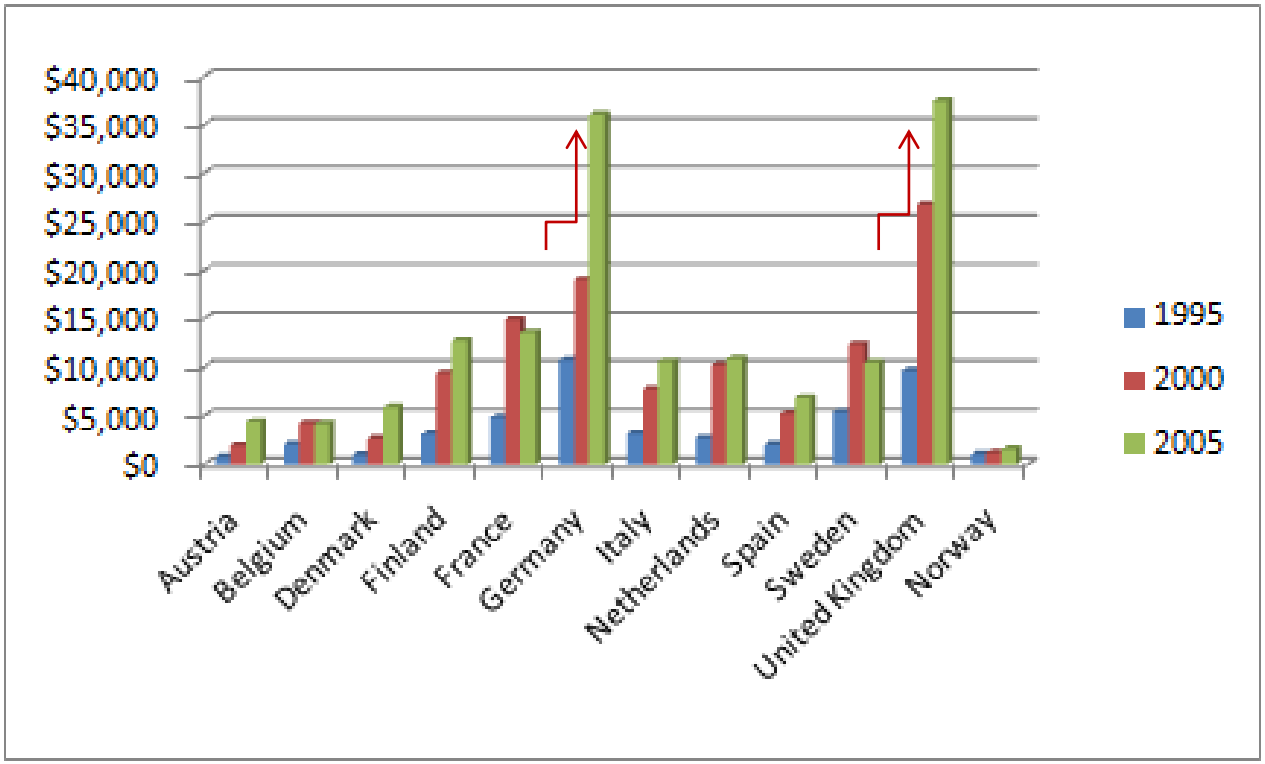


Source: ITU (2009)
Fixed telephone investment (MUS$)



Source: ITU (2009)
Mobile Telephone Service Investment (MUS$)

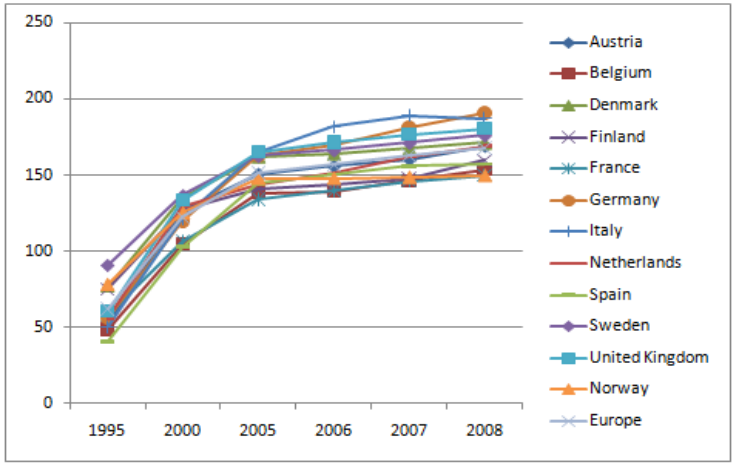
Trade volume



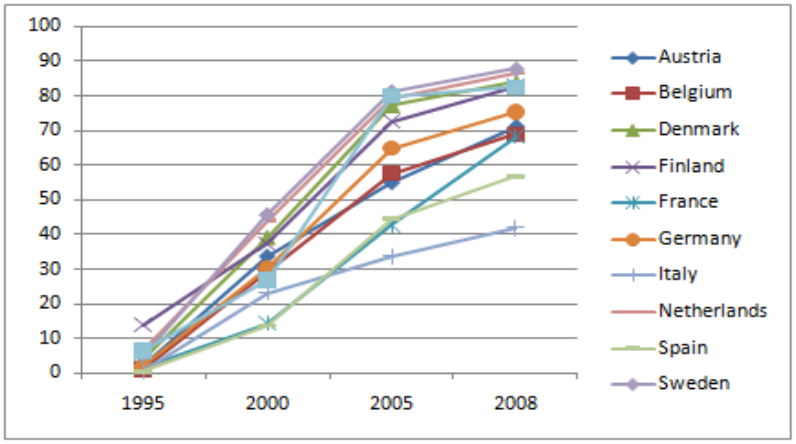
Source: ITU (2009)

Trade volume (export + import) in telecommunication equipment (MUS$)

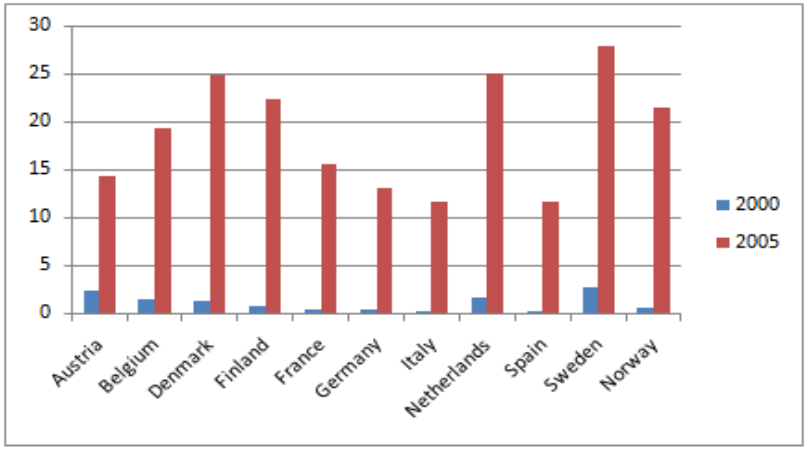
Diffusion of technology



Source: ITU (2009)
Total telephone subscribers (fixed + mobile) per 100 inhabitants



Source: ITU (2009)
Internet users per 100 inhabitants



Source: ITU (2009)
Broadband subscribers per 100

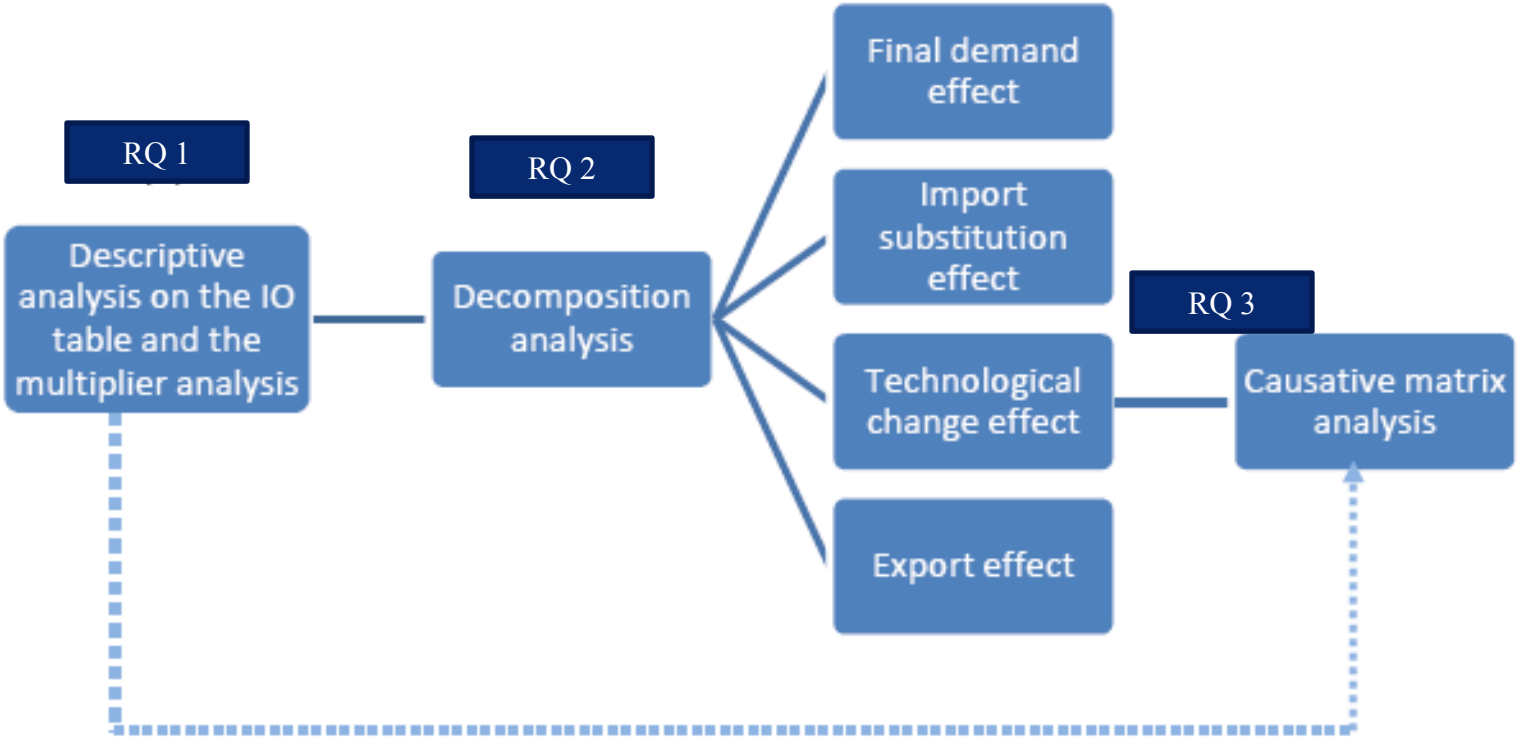
Investment is not the main reason on the lower contribution of European knowledge economy

- *"All sectors of Europe's economy depend on ICTs. We must continue to invest heavily in research and in bringing innovations to market".*

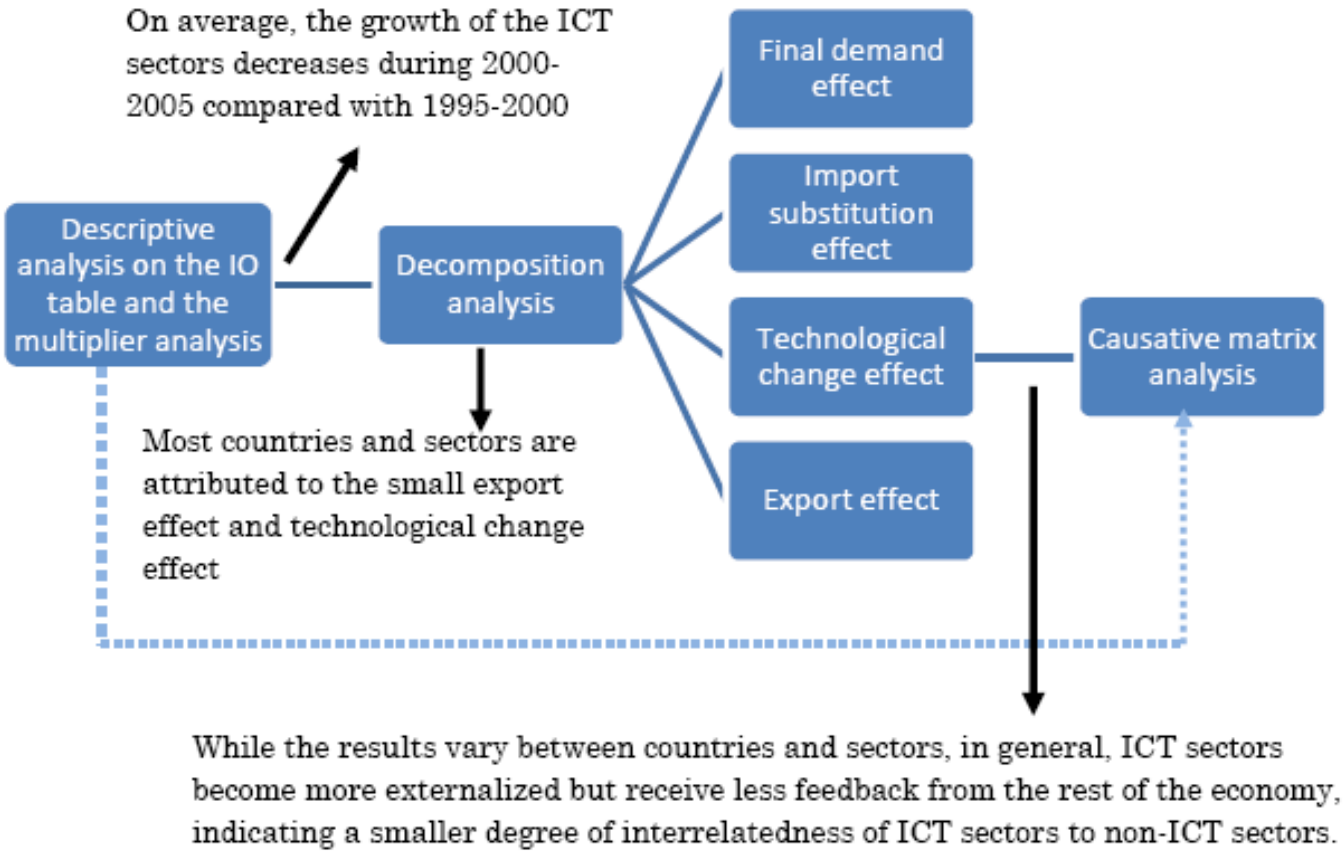
  (Viviane Reding Commissioner for Information Society and Media, http://ec.europa.eu/information_society/eeurope/i2010/docs/info_sheets/7-2a-i2010-innovation-en.pdf)

- Is it the problem of lack of investment?
- If not the problem of investment, then what?

Bohlin and Rohman (2009)



Bohlin and Rohman (2009)



Impact to the economy

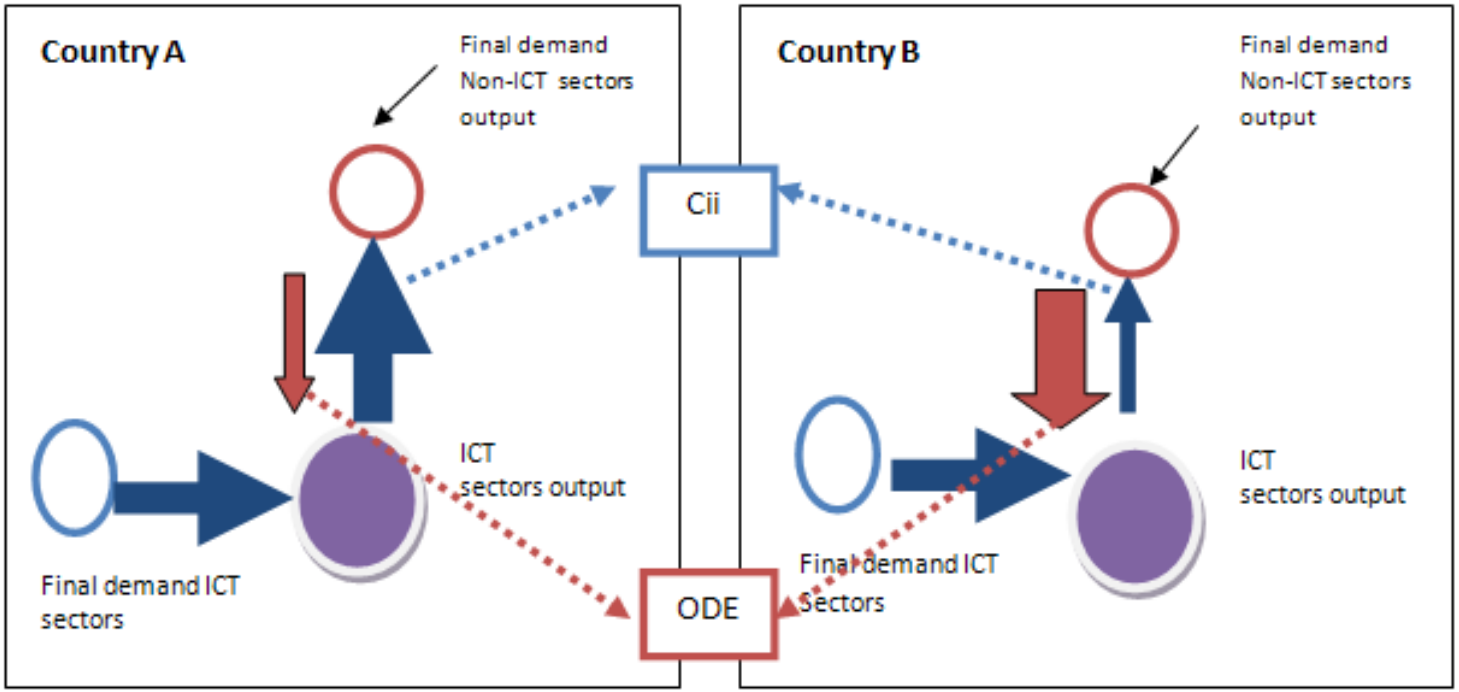
Growth of output

	1995-2000	2000-2005
Economic output	4.89%	2.37%
ICT sectors	7.31%	2.33%

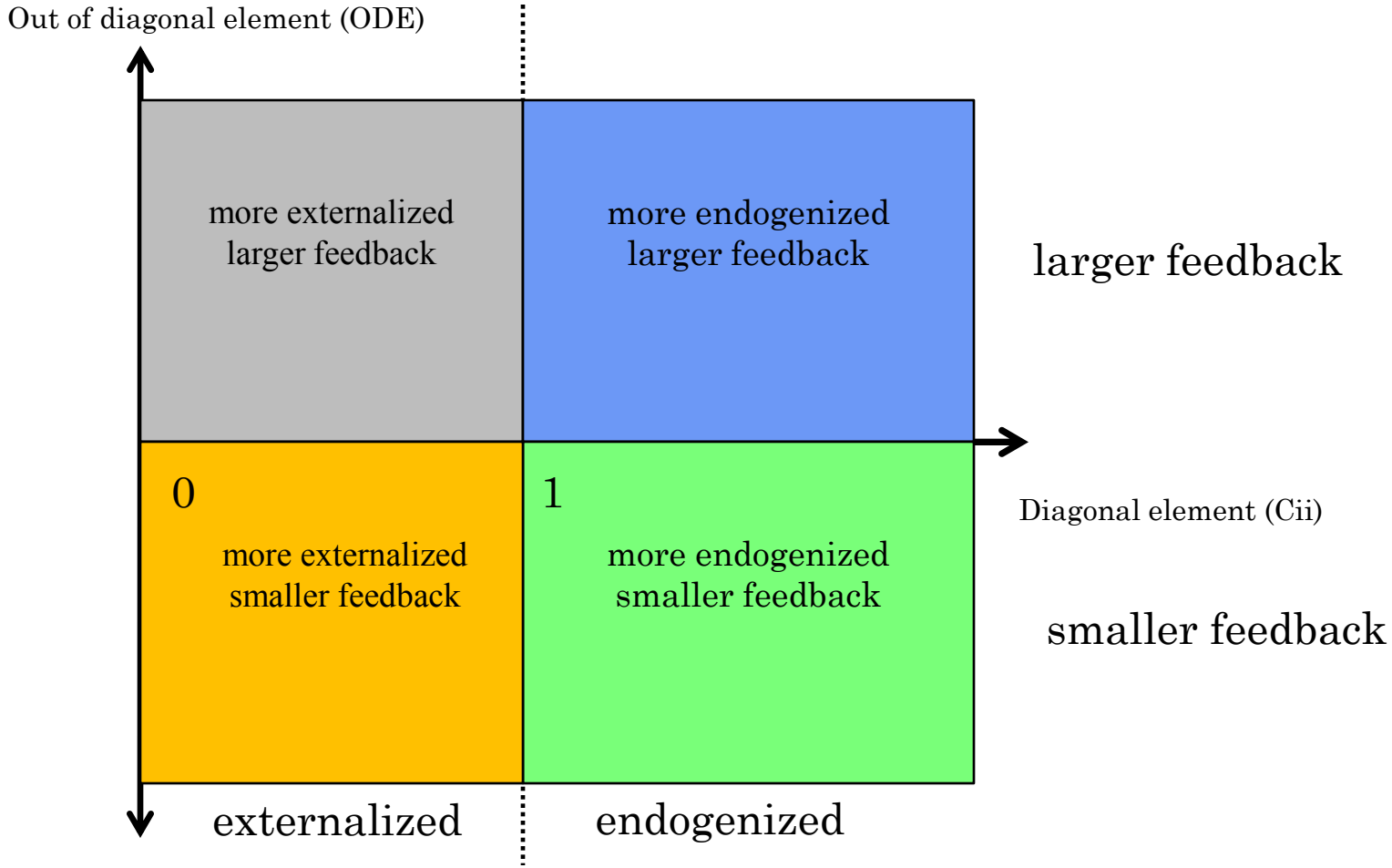
Multiplier effect

Year	ICT	Non ICT
1995	1.53	1.58
2000	1.57	1.62
2005	1.57	1.61

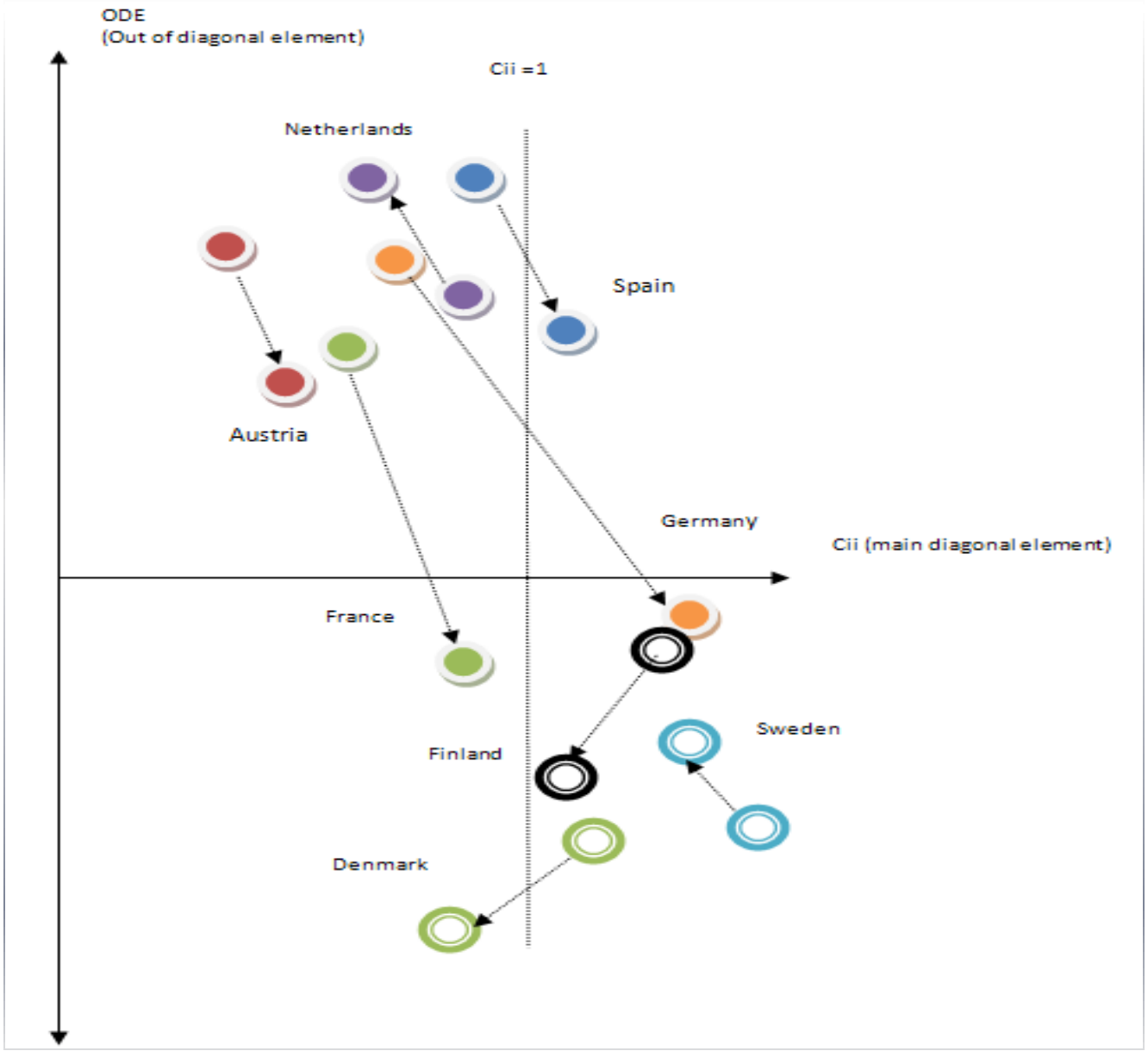
Causative matrix



Causative matrix



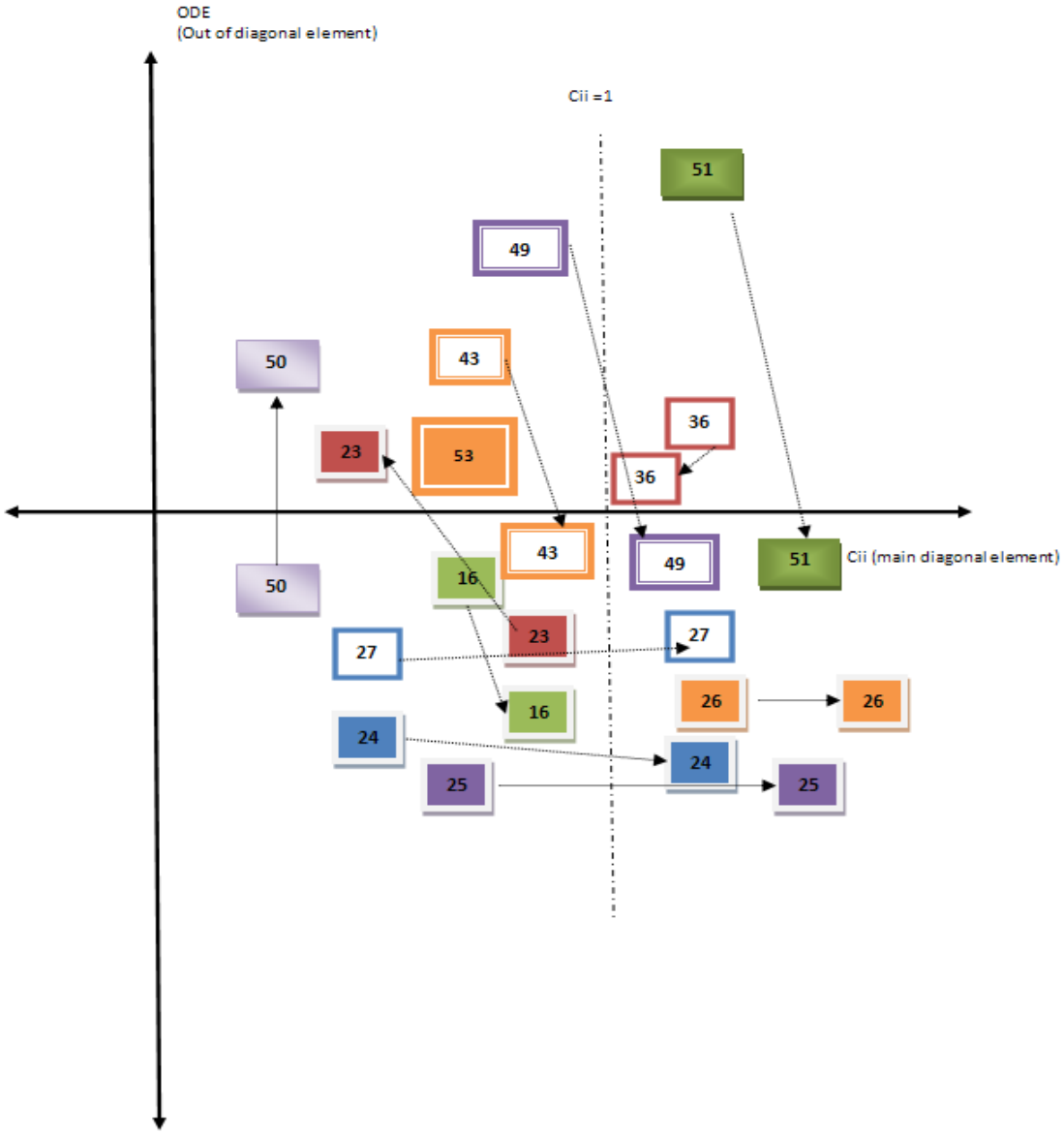
Causative matrix: Countries



Causative matrix

More externalized and larger feedback (1)	More externalized and smaller feedback (2)	More endogenized and larger feedback (3)	More endogenized and smaller feedback (4)
Sweden Netherlands	Finland Denmark Average European countries (Fig.4.13)		France Germany Spain Austria

Causative matrix: 59 sectors

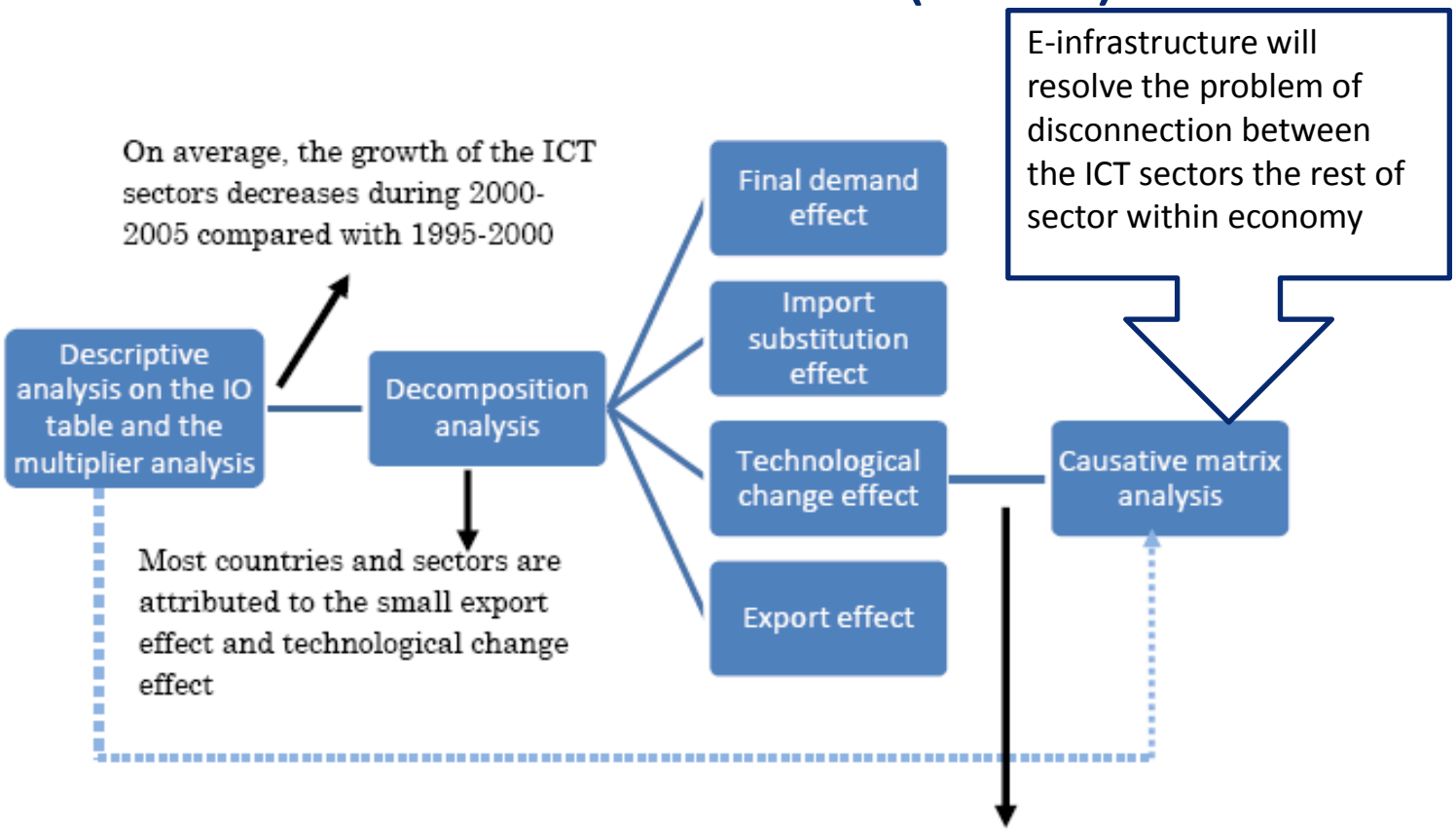


Causative matrix

More externalized and larger feedback (1)	More externalized and smaller feedback (2)	More endogenized and larger feedback (3)	More endogenized and smaller feedback (4)
Machinery and equipment Research and development services Education services	Wholesale trade and commission trade services, except of motor vehicles and motorcycles	Medical, precision and optical instruments, watches and clocks	Electrical machinery and apparatus Radio, television and communication equipment and apparatus Office machinery and computers Postal and telecommunications services Computer and related services Printed matter and recorded media

- Why E-infrastructure?

Bohlin and Rohman (2009)

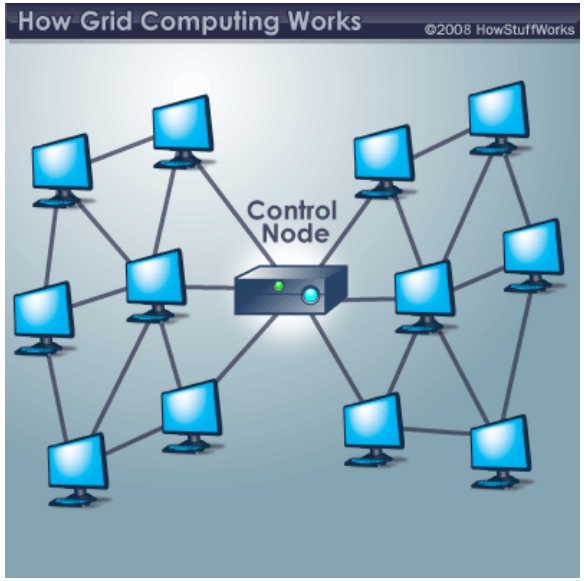


- e-Infrastructure is the term used for the technology and organizations that support research undertaken in this way. It embraces networks, grids, data centers and collaborative environments, and can include supporting operations centers, service registries, single sign-on, certificate authorities, training and help-desk services. Most importantly, it is the integration of these that defines e-infrastructure. (JISC, the UK)

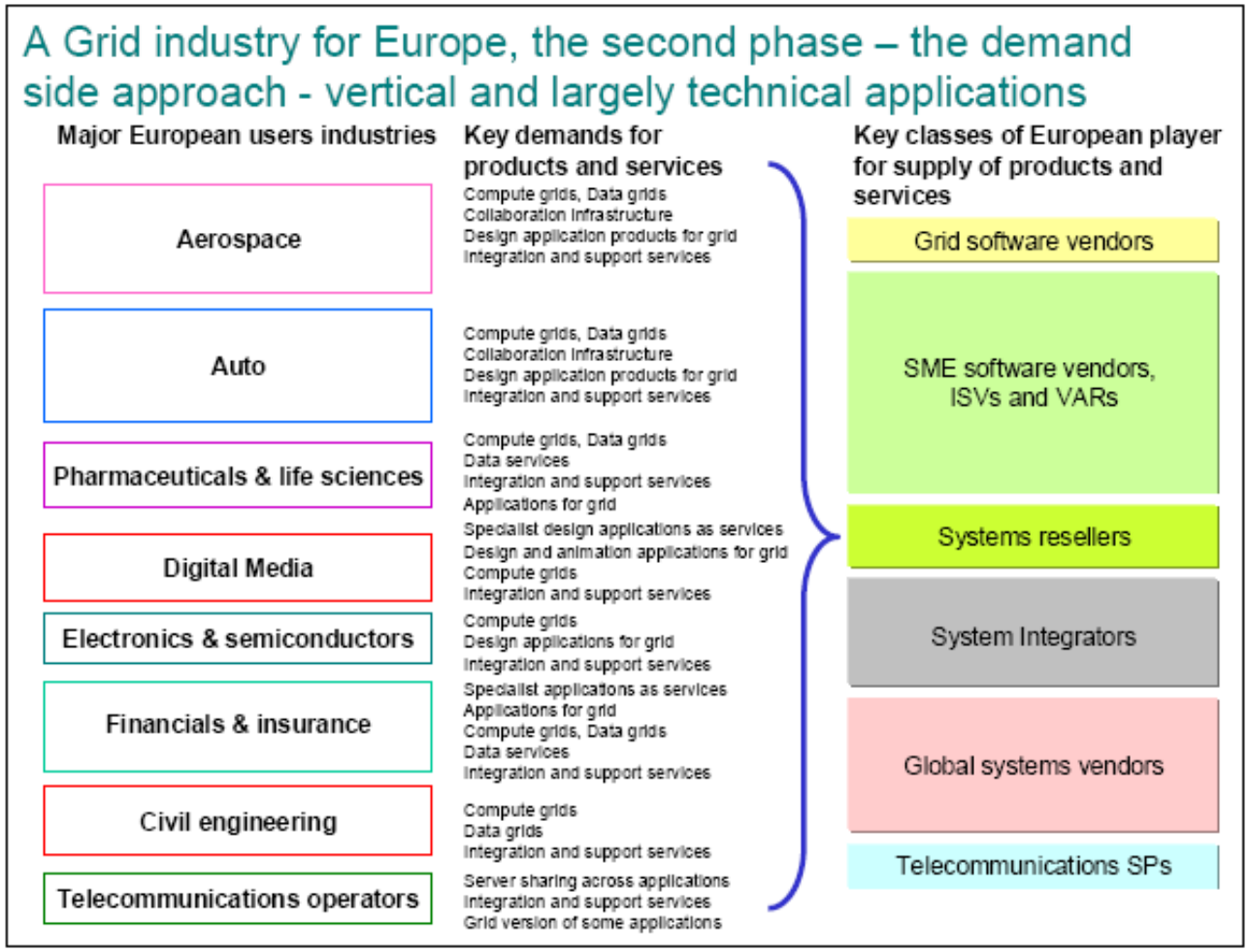
- Research is increasingly carried out through distributed regional, national and global collaborations enabled by the Internet. Such collaborations are built upon an infrastructure of **grid computing software** that can provide researchers with benefits including shared access to large data collections, advanced ICT tools for data analysis, large-scale computing resources, and high-performance visualization.

The future of E-infrastructure and grid computing

- Grid computing is seen as the availability of distributed computer power to enable the spread of computer utility like it has been on the electricity.



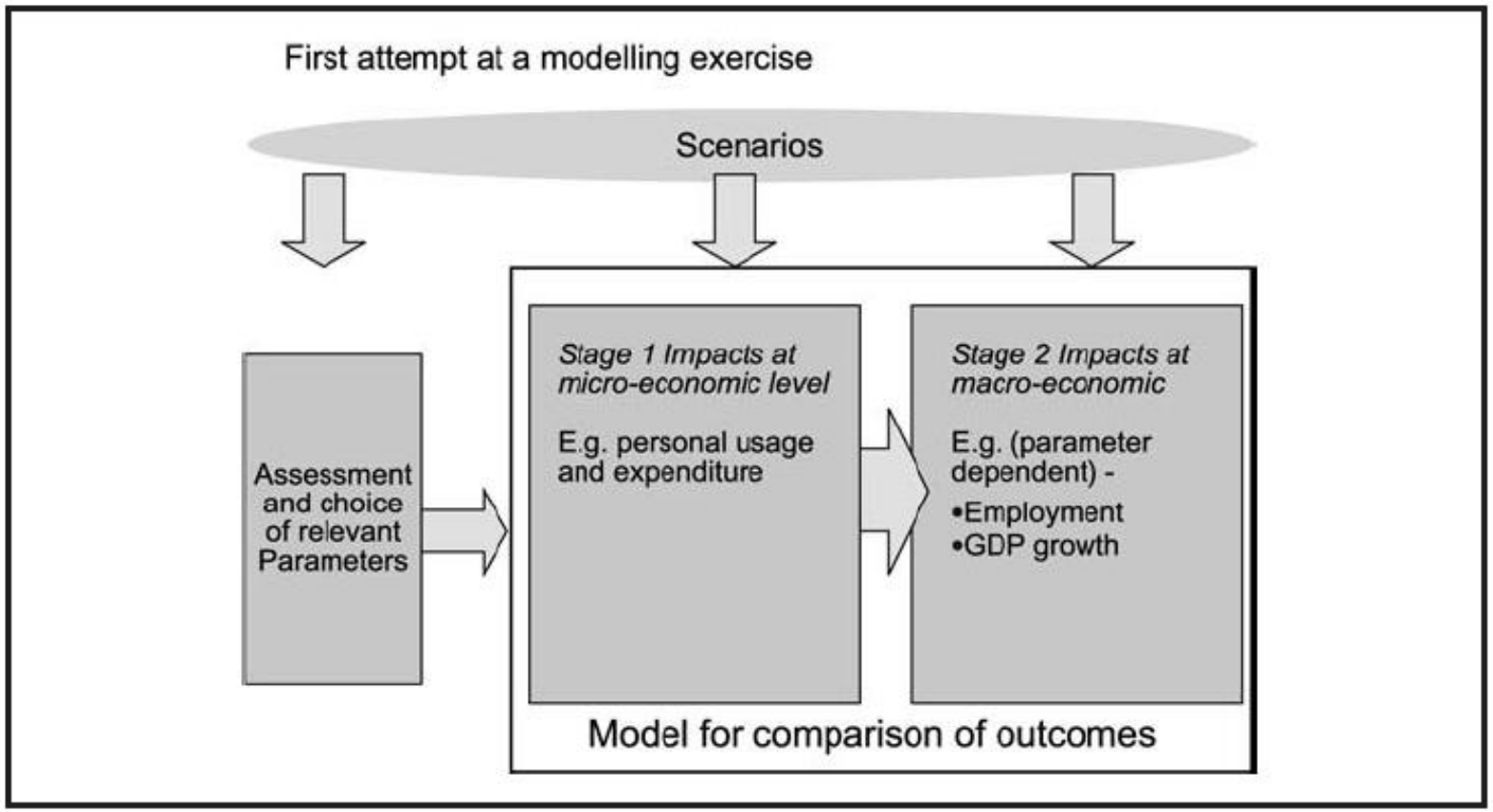
Potential application



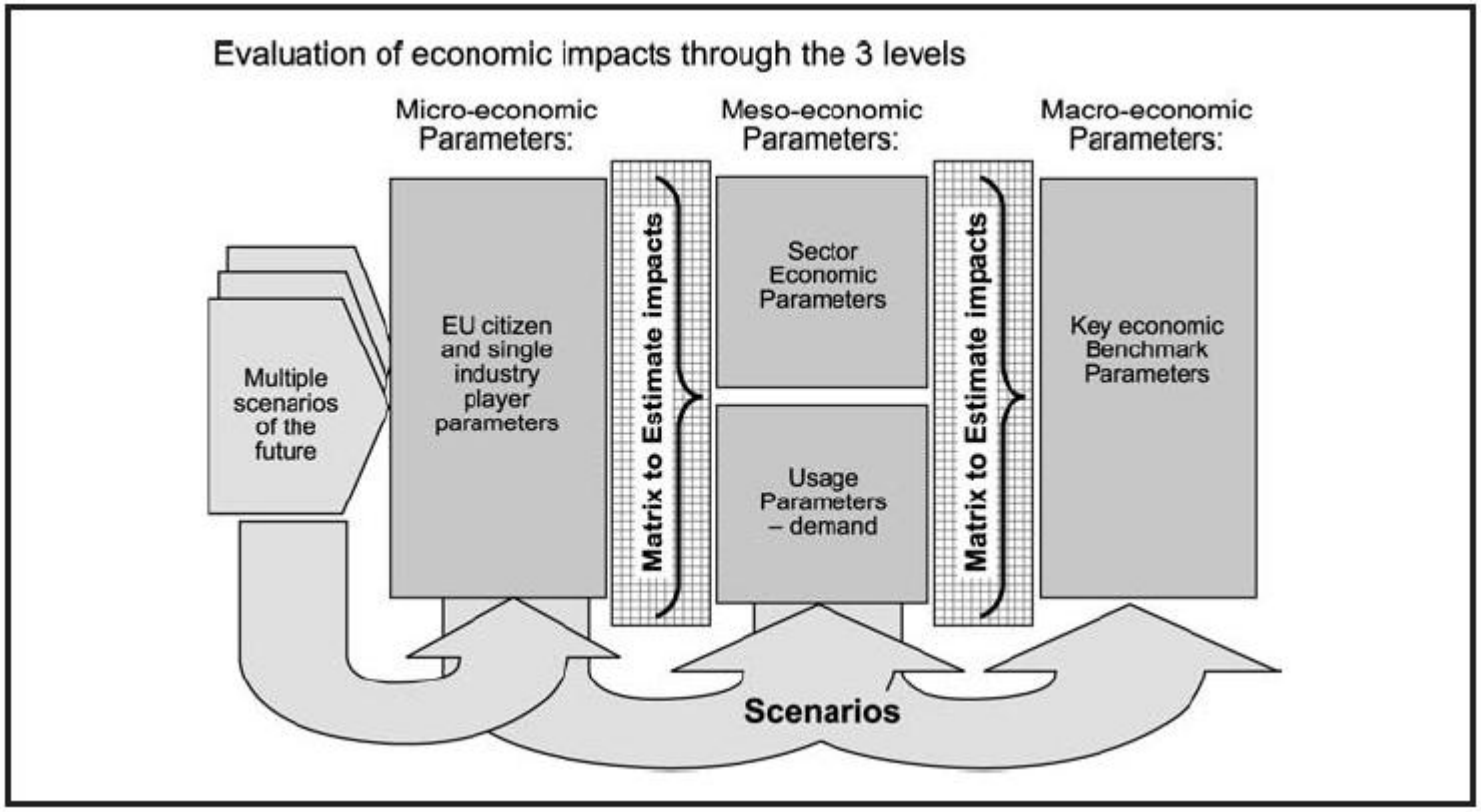
Source : Forge and Blackman (2006)

- How can we conduct the impact assessment of E-infrastructure?

Scenario analysis : Micro-macro approach



Two frameworks for evaluation analysis: Micro - meso - macro

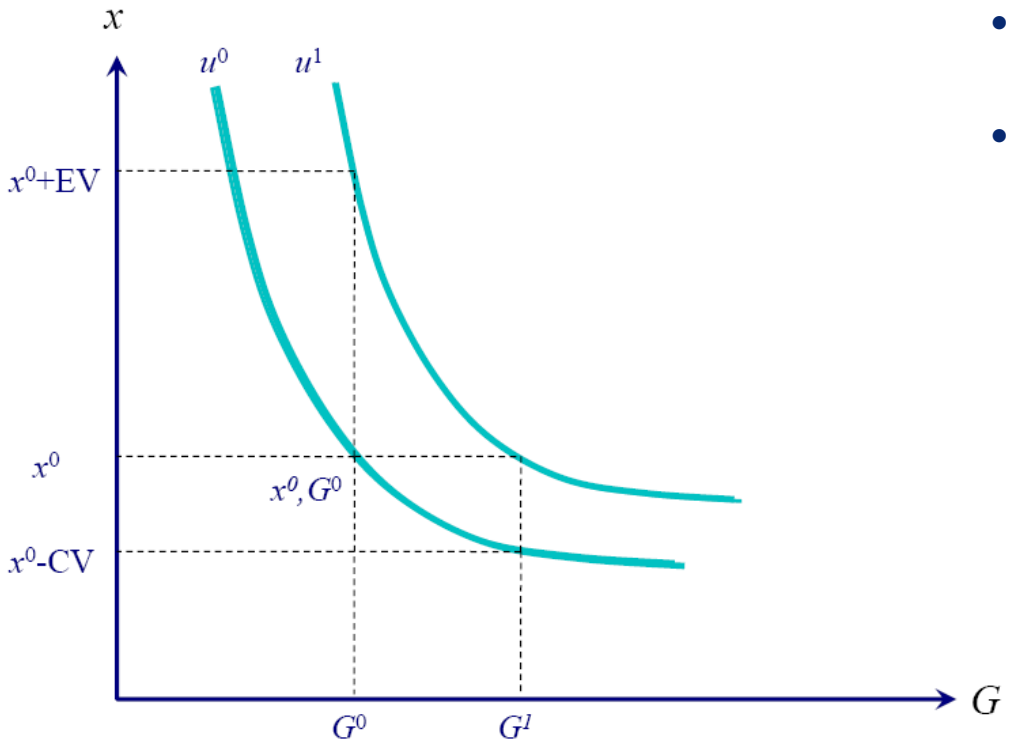


Welfare analysis

Input-Output analysis

Micro analysis

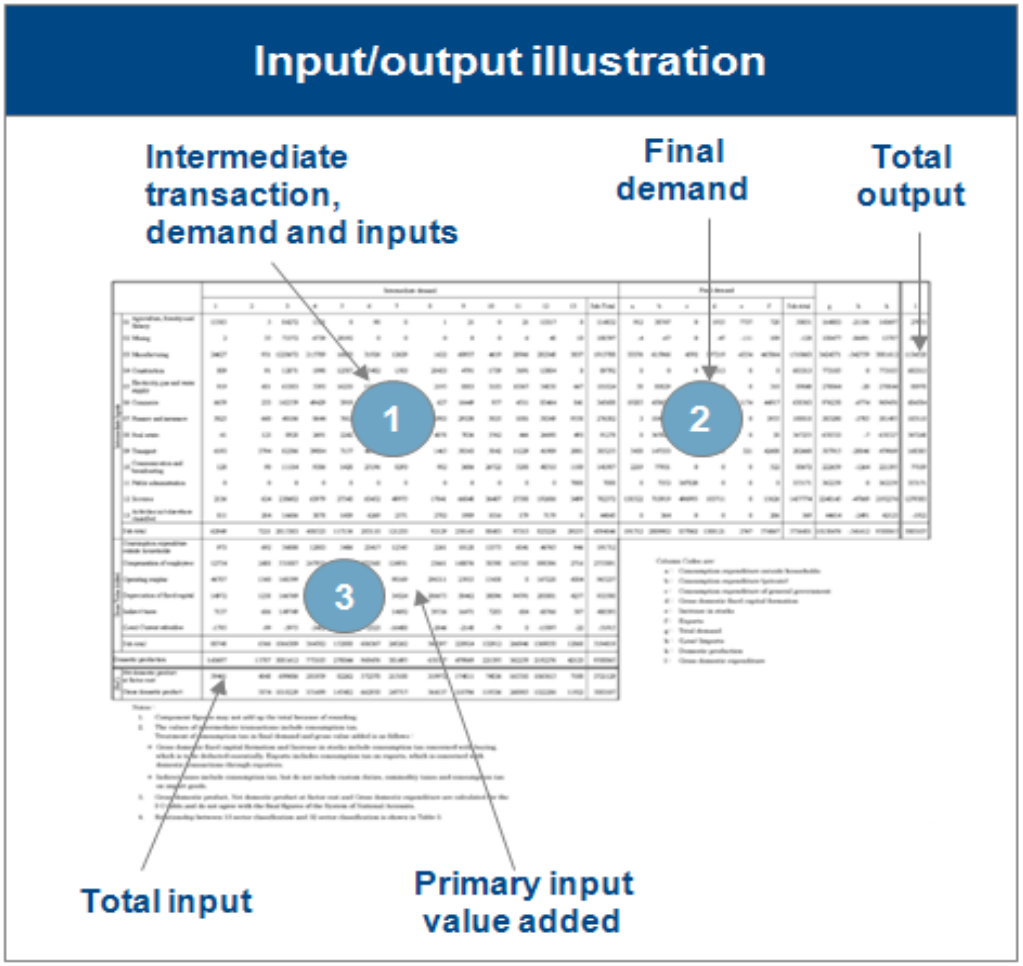
Assuming that the E-infrastructure will reduce the price level due to efficiency and increase the variety of product available in the market



- Consumer are better-off (the utility increase by U0-U1)
- There are two effects can be drawn as the efficiency gain from the consumer perspective
  - Compensating variation (CV) due to price decreases.
  - Equivalent variation (EV) which indicates the better welfare
  - **Requires the household survey data**.

Meso-macro analysis

Input/output illustration



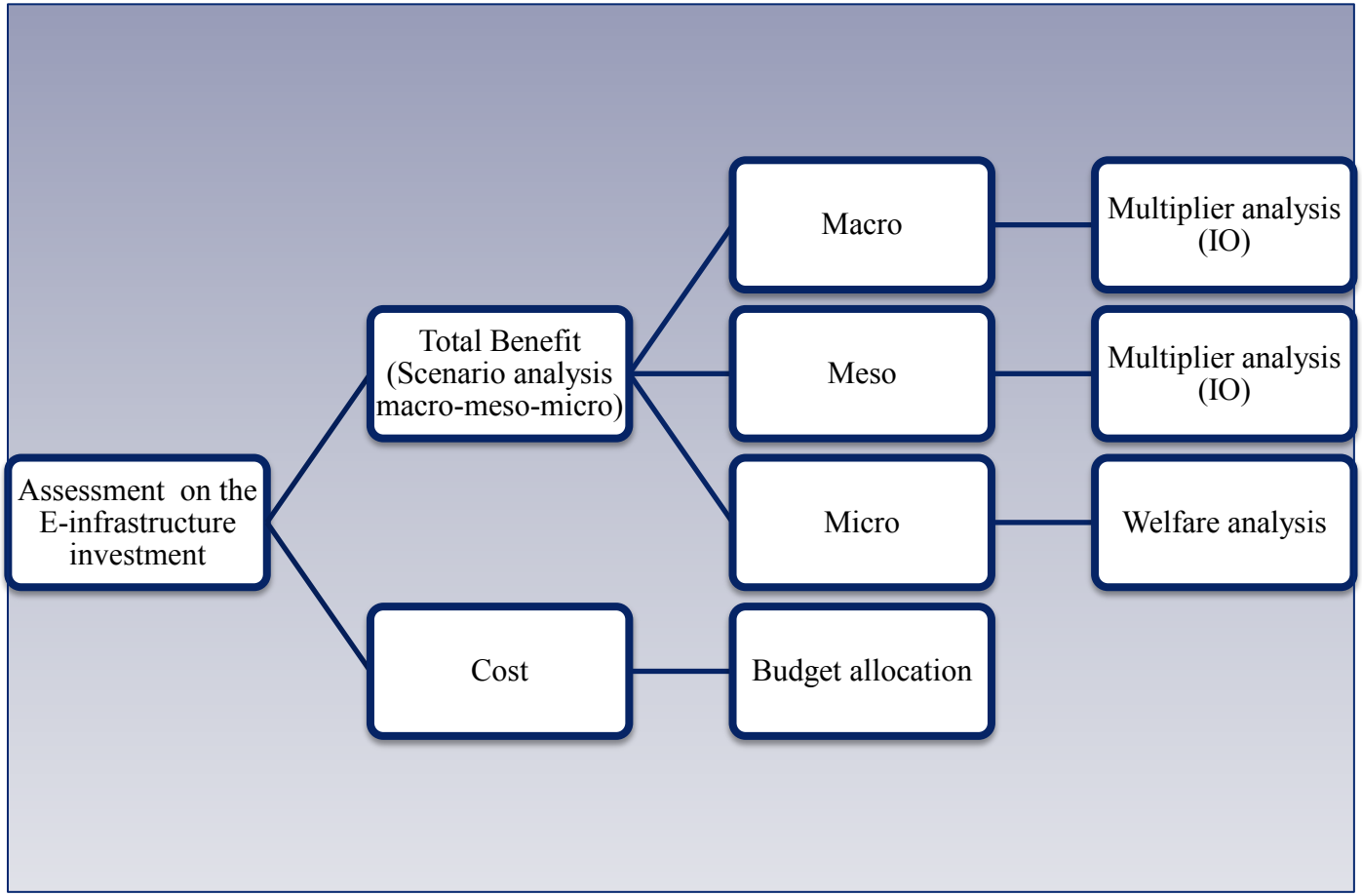
The IO method

- The table depicts the transaction flow across sectors, where each sector produces a certain output and, at the same time, consumes inputs from another sectors.
  - Thus, there is a strong ability of the methodology to capture both direct and indirect impacts of the sector due to the inter-relatedness between the industries (Yan, 1968; the United Nations, 1999; Miller and Blair, 2009).
  - There is a very close relation between IO and firm and industry data since the intermediate transaction in quadrant I consists of the data gathered from an industry survey (Yan, 1968, pp.59-60; the United Nations, 1999, p.3; Miller and Blair, 2009, p.73).
  - The relation between the IO and the macro variable is very much straightforward. The primary inputs in quadrant II reflect the measurement of the Gross Domestic Product.

The IO method

- The *output multiplier* indicates output changes in the equilibrium as the result of the better performance and activities in the sector affected by E-infrastructure. (aerospace, auto, pharmaceutical industry, digital media, etc)
  - It measures the direct and indirect impact of the sector
- In conclusion, the IO method is able to capture both direct and indirect impact as well as meso and macro impact of the particular project.

Assessment


Assessment on the E-infrastructure investment
Total Benefit (Scenario analysis macro-meso-micro)
Cost
Macro
Meso
Micro
Budget allocation
Multiplier analysis (IO)
Multiplier analysis (IO)
Welfare analysis

Remarks

- The Lisbon Strategy that aims at achieving dynamic knowledge-based economy in the European countries has yet been achieved.
- The phenomenon is instead showing the lower contribution of knowledge economy to increase productivity and growth.
- Different to previous investigation, our study shows that instead of lower investment rate in ICT being the problem, it is the disconnection between ICT sectors and the rest of economy that is more of a problem.

Remarks

- E-infrastructure built upon an infrastructure of grid computing software enables the activities with benefits including shared access to large data collections, advanced ICT tools for data analysis, large-scale computing resources, and high-performance visualisation is believed for having the ability to resolve disconnection between ICT sectors and the rest of economy.
- The impact analysis should take into account the holistic approach that measures micro-meso-macro assessment

Remarks

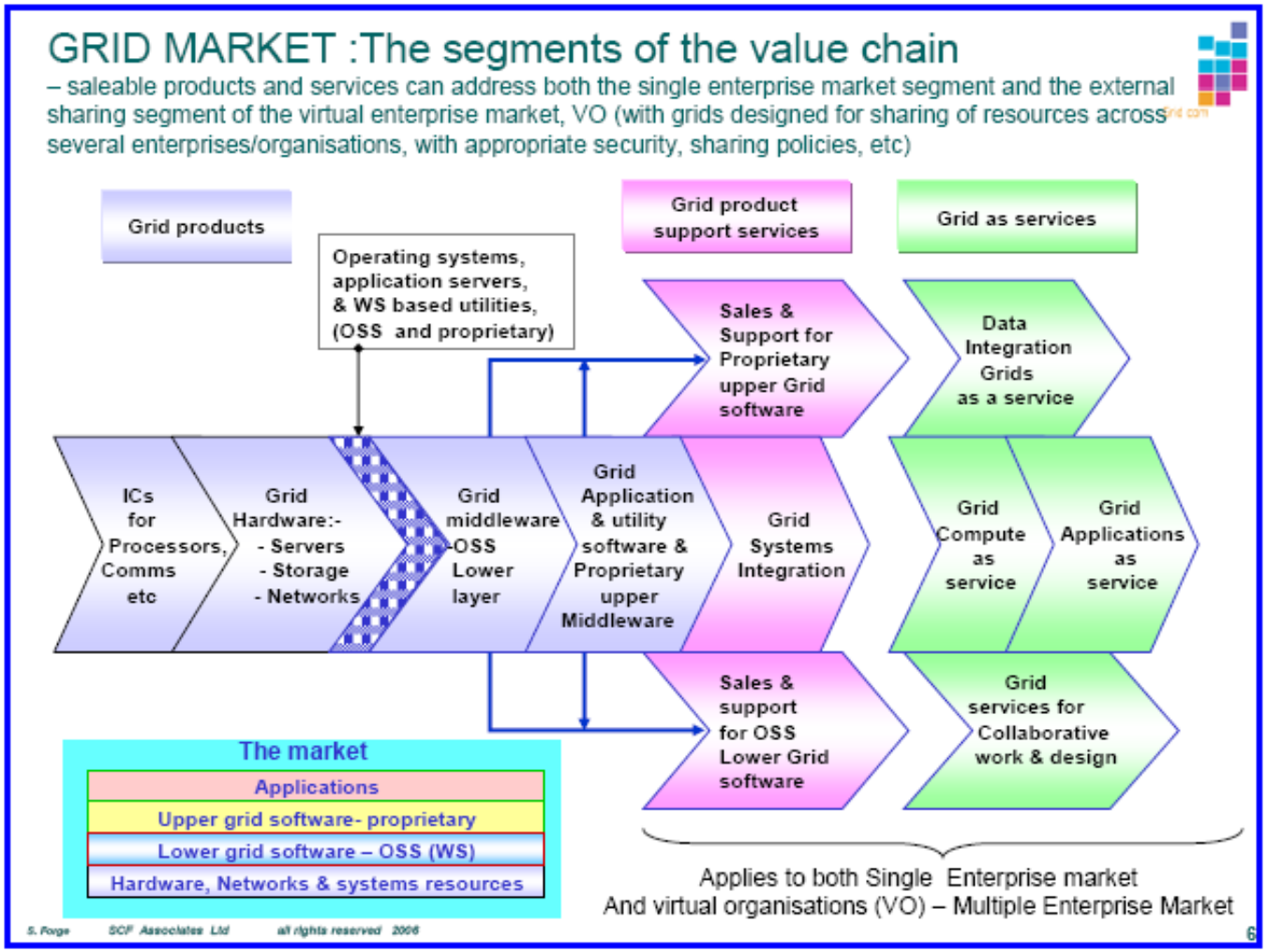
- The assessment can be implemented such a way that :
  - Micro analysis will measure the welfare change in the consumer level assuming that E-infrastructure generate efficiency level, lower cost, variety of product with more affordable price especially in the related industries auto, aerospace, digital media, electronic and semi conductor, insurance, etc.
  - The meso and macro analysis are investigated employing IO method enables us to verify the multiplier impact (direct and direct) to the economy
  - The net benefit of the infrastructure to be compared the actual budget released for establishing the E-infrastructure network within the European countries, taking into account opportunity costs for using this budget.


Thank you!

Extra slides

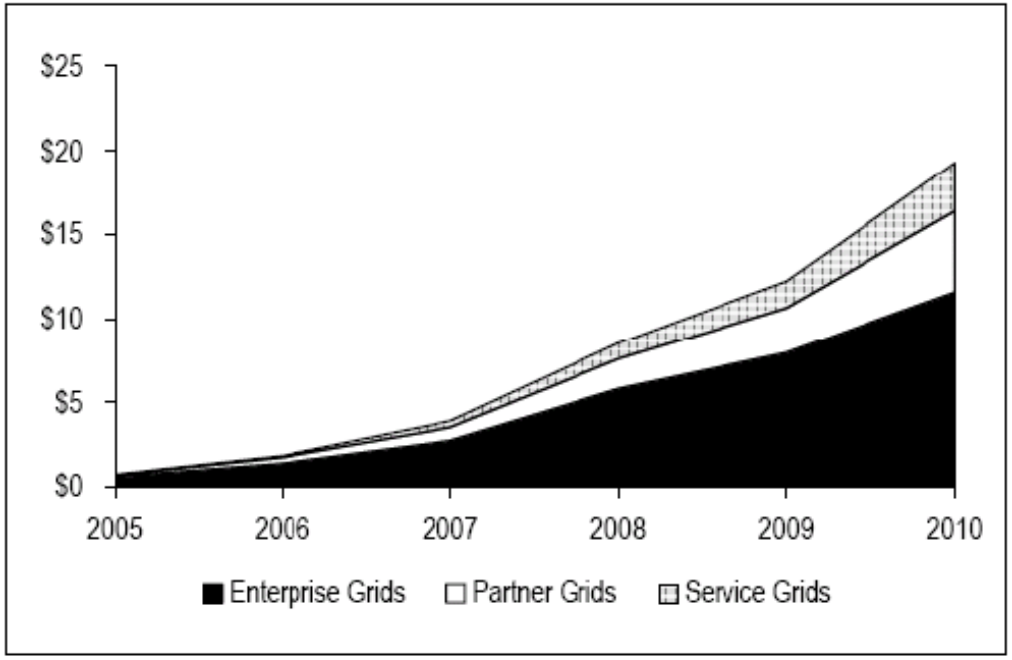
- The term **e-Infrastructure** refers to this new research environment in which all researchers - whether working in the context of their home institutions or in national or multinational scientific initiatives - have shared access to unique or distributed scientific facilities (including data, instruments, computing and communications), regardless of their type and location in the world. (European Comission)

Market and value chain



Source : Forge and Blackman (2006)

Current spending



Source: *Grid Computing: A Vertical Market Perspective 2005-2010*, The Insight Research Corporation, February 2005 (reproduced with permission) http://www.insight-corp.com/%5CExecSummaries%5CGrid05ExecSum.pdf

Worldwide grid spending, 2006-2011 ($billion)

	2006	*2007*	*2008*	*2009*	*2010*	*2011*	*CAGR*
Spending	$1.84	$3.89	$8.51	$12.21	$19.28	$24.52	67.9%

Source: *Grid Computing: A Vertical Market Perspective 2006-2011*, The Insight Research Corporation, June 2006 (reproduced with permission)
http://www.insight-corp.com/sendexec.asp?report=grid06&ReportName=Grid%20Computing%202006

Source : Forge and Blackman (2006)