



Quality of knowledge economy indicators

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**Nicole Thees**

University of Trier

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## Aim of the KEI project

- innovative and reliable *indicator system* for a multidimensional concept
  - measuring the Lisbon goals
- analysis of aggregation issues
- composite indicators
  - significance
  - identification of trends
  - performance of KBE in different countries



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## Quality importance

- measuring performance
- data sources
  - survey samples, administrative
- target group
  - policy makers at the European and national levels
- indicators results for political conclusions
  - accuracy and statistical reliability of indicators and additional quality information
    - indicator weakness
    - guide the selection of indicators



## Problem

- variety of economic indicators
- variety of quality information which differ thru the countries

## Solution

- measuring quality by a composite indicator of quality



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## Data requirements

- measuring the development of KBE in several countries
- potential as composite indicator
- aspects to be considered - not limited to a 'R&D' view -
  - key economic sectors
  - input and output indicators
  - life and work in the KBE
  - national performance for innovation and globalization



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## Indicators

- four main drivers and characteristics - Group A
  - A1 - production and diffusion of ICTs (20 indicators)
  - A2 - human resources, skills and creativity (20)
  - A3 - knowledge production and diffusion (26)
  - A4 - innovation, entrepreneurship and creative destruction (20)
- two main outputs - Group B
  - B1 - economic indicators (7)
  - B2 - social performance (21)
- two horizontal indicators - Group C
  - C1 - public sector innovation (5)
  - C2 - internationalization (25)

⇒ 144 indicators



## General or Special Data Dissemination System (GDDS / SDDS)

- assessing national statistical systems
- promote a improved dissemination and effectiveness
- Eurostat NewCronos: 5 dimensions + methodological summary

SDDS	→ Coverage, Periodicity and Timeliness
	→ Access by the Public
	→ Integrity (transparency of practices and procedures)
	→ Quality (information the user needs to assess data quality)
	→ Dissemination Formats
summary methodology	→ Concepts, definitions and classifications
	→ Scope / coverage of the data
	→ Accounting conventions
	→ Nature of the basic data
	→ Compilation practices (data processing)
	→ Other aspects



## Data Quality Assessment Framework - IMF / Assessment of Quality in Statistics - Eurostat

- general methodology for assessing data quality
- international concepts and definitions in statistics
- Assessment of Quality in Statistics of Eurostat:

<b>main level</b>	→ <b>relevance</b>	<b>sub dimensions</b>	description of more comprehensive needs
			reasons for incompleteness, future solutions
			circulation and /or readership of publications
	→ <b>accuracy</b>		general
			sampling errors
			non-sampling errors
→ <b>timeliness and punctuality</b>		geographical comparability	
→ <b>accessibility and clarity</b>		comparability over time	
→ <b>comparability</b>		comparability between domains	
→ <b>coherence</b>			
→ <b>cost and burden</b>			



## Valuation

- information aggregation
  - measuring the proportion of available issues
  - quality scores
- assumption
  - each kind information is valuable for the user
  - the use of a quality information is neglected



## First result - rate of availability

- 7 indicators (5 group A, 2 group B)

	group	main sub-group	indicator
1	<b>A1</b>	<i>production and diffusion of ICT</i>	investment in ICT / GDP
2	<b>A2</b>	<i>skilled human resources</i>	total researchers / thousand labour force in FTE
3	<b>A3</b>	<i>knowledge production</i>	BERD / GDP
4	<b>A4</b>	<i>entrepreneurship</i>	enterprise churn
5	<b>A4</b>	<i>structural and organisational change</i>	% SMEs reporting non technological change
6	<b>B1</b>	<i>economic outputs</i>	labour productivity / hour worked
7	<b>B2</b>	<i>social performance</i>	inequality of income distribution

- one point in time
- general information offered by the metadata
- no separation by countries

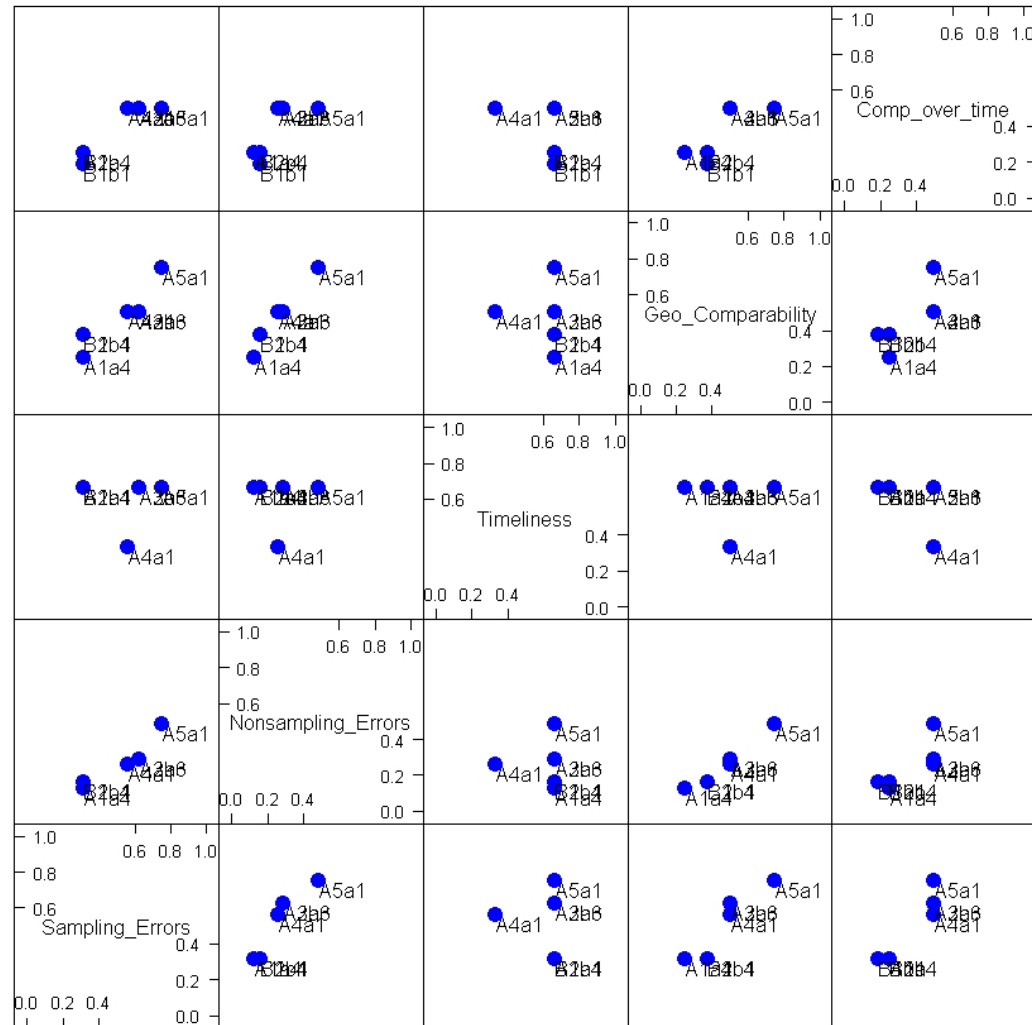


## Rate of availability

economic indicator	relevance				accuracy			timelines & punctuality	quality indicator		comparability				coherence	cost & burden	extra-ordinary
	R1	R2	R3	R4	A1	A2	A3	TP	accessibility and clarity	AC	C1	C2	C3	C4	CH	CB	EX
1	1	1	0	0	0	0.313	0.129	0.667	0.167	0.250	0.250	0	0	0	0	0	
2	1	1	0	0	0	0.625	0.290	0.667	0.167	0.500	0.500	0	0	0	0	0	
3	1	1	0	0	0	0.625	0.290	0.667	0.167	0.500	0.500	0	0	0	0	0	
4	1	1	0	0	0	0.563	0.258	0.333	0.167	0.500	0.500	0	0	0	0	0	
5	1	1	0	0	0	0.750	0.484	0.667	0.167	0.750	0.500	0	0	0	0	0	
6	1	1	0	0	0	0.313	0.161	0.667	0.167	0.375	0.188	0	0	0	0	0	
7	1	1	0	0	0	0.313	0.161	0.667	0.167	0.375	0.250	0	0	0	0	0	



## Rate of availability - discrimination ability





## Rate of availability

→ equal weights of the quality indicators

economic indicator	quality indicator						quality ranking median
	accuracy		timelines & punctuality	accessibility and clarity	comparability		
	A2	A3	TP	AC	C1	C2	
1	2.0	1.0	4.5	1.0	2.5	2.0	2.0
2	5.5	5.5	4.5	5.0	5.5	5.5	5.5
3	5.5	5.5	4.5	5.0	5.5	5.5	5.5
4	4.0	4.0	1.0	5.0	5.5	4.0	4.0
5	7.0	7.0	4.5	7.0	5.5	7.0	7.0
6	2.0	2.5	4.5	2.5	1.0	2.5	2.0
7	2.0	2.5	4.5	2.5	2.5	2.5	2.0

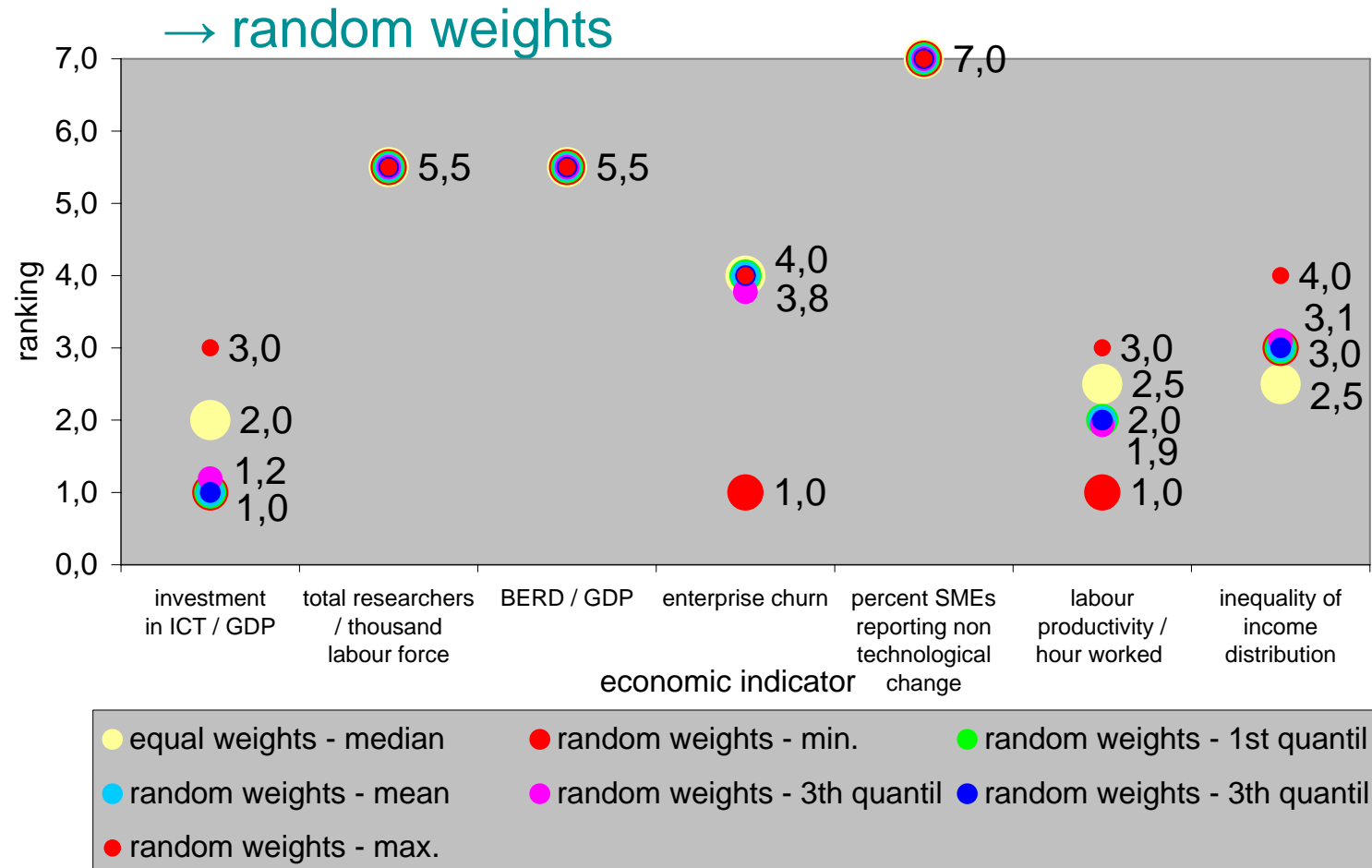


## Random weights

	quality indicator				
	accuracy		timelines & punctuality	comparability	
	A2 sampling errors	A3 non sampling errors	TP timelines & punctuality	C1 geographical comparability	C2 comparability over time
<b>Min.</b>	2.51E-07	3.30E-07	4.03E-07	1.28E-06	7.74E-08
<b>1st Qu.</b>	1.11E-01	1.11E-01	1.11E-01	1.11E-01	1.11E-01
<b>Median</b>	2.00E-01	2.00E-01	2.00E-01	2.00E-01	2.00E-01
<b>Mean</b>	2.00E-01	2.00E-01	2.00E-01	2.00E-01	2.00E-01
<b>3rd Qu.</b>	2.77E-01	2.77E-01	2.77E-01	2.77E-01	2.77E-01
<b>Max</b>	9.384e-01	9.379e-01	9.066e-01	9.053e-01	8.828e-01



## Ranking of economic indicators





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## Conclusions

- economic indicators are not sensitive for any the kind of existing quality
  - important to have any quality information possible?
  - equivalence of information?
    - sampling design
    - sampling error
    - geographical comparability
- factor analysis with principal component
  - importance of single quality information
  - factors having influence on the ability of quality information
  - recommendation on the quality provision



## Factor analysis with principal component

→ correlations between the specific quality dimensions

	sampling errors	non sampling errors	timeliness & punctuality	geographical comparability	comparability over time
sampling errors	1.0000000	0.93335277	-0.14978617	0.9032446	0.9435133
non sampling errors	0.9333528	1.0000000	-0.01675054	0.9797979	0.7791756
timeliness & punctuality	-0.1497862	-0.01675054	1.0000000	-0.1005038	-0.3499482
geographical comparability	0.9032446	0.97979794	-0.10050378	1.0000000	0.7548264
comparability over time	0.9435133	0.77917561	-0.34994824	0.7548264	1.0000000



## Factor analysis with principal component

economic indicator	equal weights median	random weighting Median	quality ranking result of the factor analysis			
			5 quality indicators		4 quality indicators	
			component number			
			2	3	2	3
1	2.0	1.0	1	1	1	1
2	5.5	5.5	6	6	6	6
3	5.5	5.5	5	5	5	5
4	4.0	4.0	4	4	4	4
5	7.0	7.0	7	7	7	7
6	2.5	2.0	2	2	2	2
7	2.5	3.0	3	3	3	3



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## Factor analysis with principal component

- quality ranking of the economic indicators is verified
- ranking between indicator two and three is more evident
- standard deviation
  - one component contribute the main explanation
    - proportion of variance:  
74% (5 quality aspects) to 91% (5 quality aspects)
- first hypothesis
  - the existence of methodological manuals facilitate the supply with quality information



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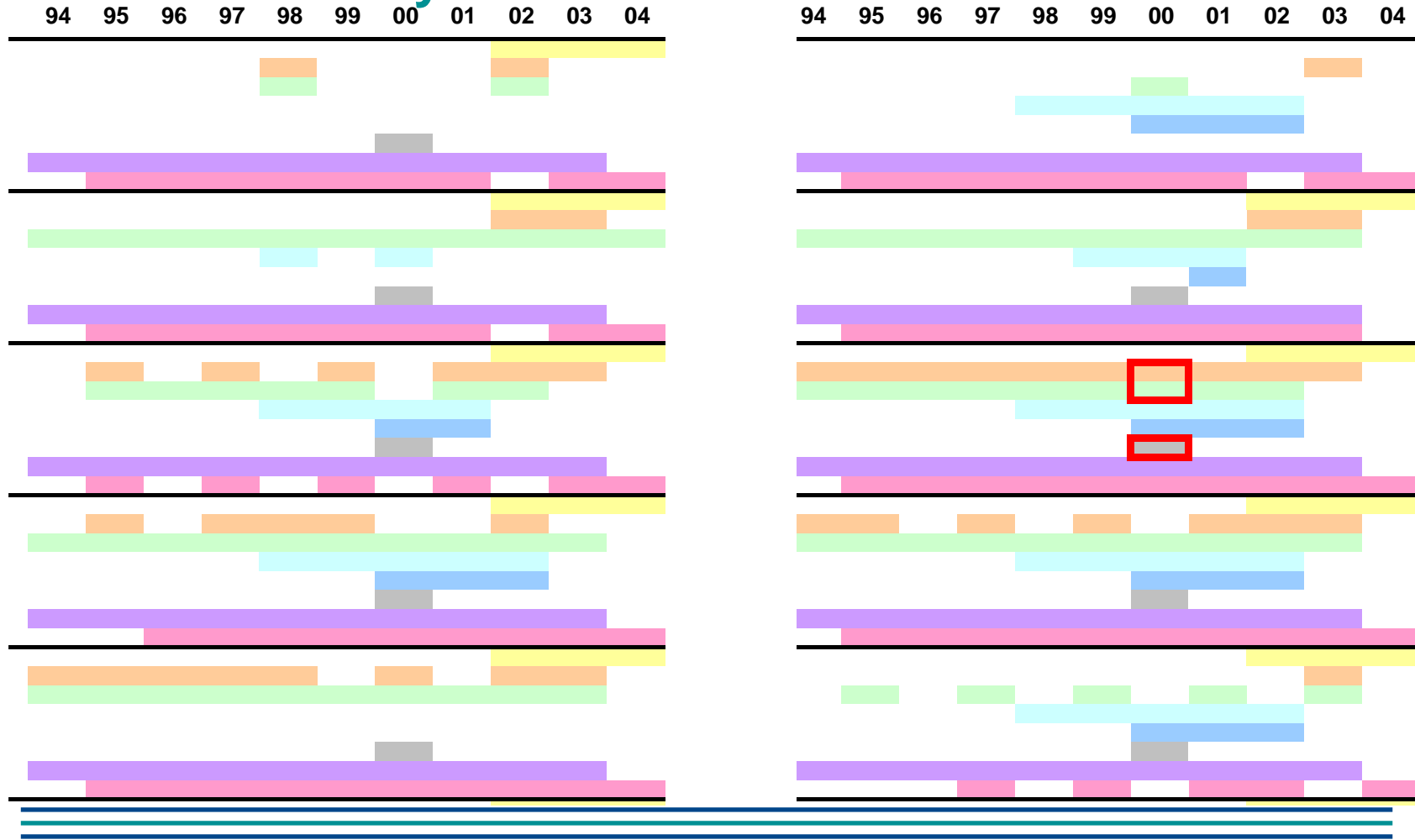
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## Result

- analysis of quality information supply
  - first adequate method to build a ranking of indicators
  - basis of indicators selection
- methodological manuals: adequate instrument to perform and facilitate the availability of quality information
  - may be confirmed by an analysis of quality information on the country level
- exception
  - some information (e.g. sampling errors) as well as the data availability are a must for developing composite indicator



## Data availability





## Outlook

- analysis of the availability of quality information
  - for all indicators
  - on the country level
- analysis of data availability
- evaluation of a composite indicator