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Quality Measurement and Quality Management Frameworks

The Data Quality Program for the Statistical Business Registers in the European Statistical System

1 Introduction

Eurostat has the role to coordinate the network of Statistical Business Registers (SBRs) in the European Statistical System (ESS)[1]. The network of SBRs in the ESS is made of the national Statistical Business Registers (NSBRs) and the EuroGroups Register (EGR).

The final (long-term) goal is the full backbone role of the network of SBRs in the ESS. In order to achieve such goal the network must be equipped with an overall quality management ensuring high quality of the data in the NSBRs and in the EGR.

The present BR Regulation[2] clearly states (Article 6 and 9) that:

- "*Member States shall take all measures necessary to ensure the quality of the business registers*" (6.1);
- "*Member States shall provide Eurostat, on its request, with a report on the quality of the business registers*" (6.2).
- "*Member States shall transmit Eurostat, at its request, any relevant information with regard to the implementation of the BR Regulation*" (9.2).

These provisions were put into practice, from 2009 to 2015, through the so called "Annual Inquiry". A form was distributed each year from Eurostat to EU Member States, EFTA countries, Candidate Countries and Potential Candidate Countries, asking for information on the characteristics in the NSBR. The main goal of the Annual Inquiry was to investigate on the NSBRs compliance with the mandatory elements in the BR Regulation, following the provisions of article 9.2. More general explanations on production processes and methodology were also included occasionally. Each yearly exercise was concluded with an Eurostat report summarizing the main results of the Annual Inquiry.

[1] The ESS also includes Iceland, Liechtenstein, Norway and Switzerland

[2] Regulation (EC) No 177/2008

The approach described suffered of the following weaknesses:

- The Annual Inquiry was just a compliance exercise and not a full quality exercise; it answered correctly to the provisions of article 9.2 but only partially[3] to the provisions of article 6.2;
- Only NSBRs (and not EGR) were covered by the Annual Inquiry.

This does not mean that NSIs did not take measures to ensure the NSBRs quality and Eurostat did not take measures to ensure the EGR quality. However there was a lack of coordination, of harmonised evaluation of the quality and of an ESS vision on the detailed target objectives and the necessary actions to achieve these objectives.

Therefore in 2015 Eurostat launched an annual Data Quality Program (DQP) for the SBRs in the ESS, in line with the general ESS standard quality pillars, which are quality reporting, quality standards, quality assessment and quality improvement.

This paper deals with the main features of the DQP, its achievements till now and the plans for the near future.

2 The Data Quality Program (DQP)

The DQP intends to:

- assess the quality level by setting and monitoring quality standards;
- recommend good practices;
- harmonize methodology and processes in the production and dissemination of NSBRs and EGR;
- promote the use of common IT tools/services and best practices.

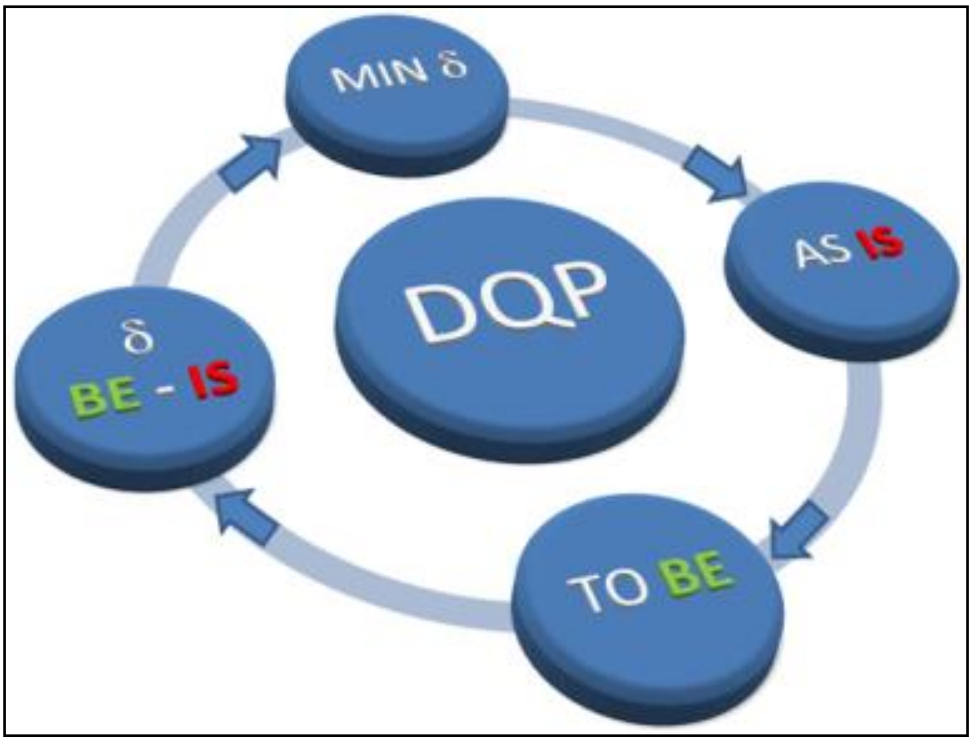
The overall objective for the DQP is to achieve substantial improvement of the network of SBRs quality, allowing the full achievement of the backbone role for the production of business statistics in the ESS.

In line with the general ESS quality standards, the DQP is made of four main components:

- Part (A): Reporting or "*As-Is*".
- Part (B): Defining the targets or "*To-Be*".
- Part (C): Assessing or "Gap between To-Be and As-Is".
- Part (D) Improving or "Reducing the Gap".

These four components are to be followed cyclically each year as represented in picture 1.

[3] As the legislation does not cover all the user needs but at least the essential ones, the compliance targets are considered "minimum quality targets".



***Picture 1**: The ESS Data Quqlity Program cycle for the Statistical Business Registers*

3 Achievements of the DQP cycle in 2016 and in the first part of 2017

The first DQP cycle in 2016 has focused on:

- describing annual routines;
- developing standardized templates;
- gradually implementing the four parts of the program.

In 2017 the DQP is fully in production. Some fine tuning of the components is still going on, in particular concerning the establishment of targets and the following assessment.

3.1 Part A – Annual quality reporting (As is state)

Part A aims to settle a standardized quality and metadata reporting for NSBRs and EGR. The information and indicators provided with the annual quality reports is used to monitor and asses the SBRs quality.

To better inform users on the background of SBRs, meta-data reports on NSBRs and the EGR have been established and are published annually.

Specific templates, following the ESS Standards[4], were developed.

[4] The Euro-SDMX Metadata Structure (**ESMS**) is the unique structure in use in Eurostat for the collection and dissemination of reference metadata at European level. The ESS Standard for Quality Reports Structure (**ESQRS**) is the standard structure for the collection of quality reports from the NSIs.

Quality and meta-data reports follow in principle the same high-level concepts. Some ad-hoc simplifications were introduced for SBRs. The high-level concepts used by the ESS Standards are shown in picture 2.

1. Contact
2. Metadata update
3. Statistical presentation
4. Unit of measure
5. Reference Period
6. Institutional Mandate
7. Confidentiality
8. Release policy
9. Frequency of dissemination
10. Accessibility and clarity
11. Quality management
12. Relevance
13. Accuracy
14. Timeliness and punctuality
15. Coherence and comparability
16. Cost and Burden
17. Data revision
18. Statistical processing
19. Comment

Related Metadata

Annexes (including footnotes)

***Picture 2**: The high level concepts used in the standard ESS structures for quality and meta-data reporting*

The main achievements can be summarized as follows.

3.1.1 NSBRs quality report

In 2016 and in 2017 just the template submitted to the NSIs was new (according to the ESQRS). The content of the national quality report was for a large extent the same as for the former Annual Inquiry.

Eurostat uses the information collected through the NSBR quality reports to monitor the compliance and achievement of minimum targets. In the coming years the achievements towards extended quality targets will be monitored too.

3.1.2 NSBRs meta-data report

The first NSBRs meta-data exercise was launched in 2016 using the ESMS standard structure and repeated in 2017. Previously some meta-data information was collected, in a less structured and regular manner, through the Annual Inquiry.

Eurostat produces a synthesis report of the NSBRs meta-data reports and uploads it to CIRCABC.

3.1.3 EGR quality report

The first EGR quality report was established in 2016 using the ESQRS standard structure. In the quality management assessment (concept 11) it was recognized that a better set of quality indicators was still under development.

These indicators will be taken into account for the 2017 quality report.

3.1.4 EGR meta-data report

Eurostat produced in 2016 the first EGR meta-data report using the ESMS standard structure and is preparing the 2017 report.

Eurostat publishes the quality and the meta-data reports in the EGR wiki, accessible to the ESS experts working on EGR or using it.

3.2 Part B – Quality targets (To-be state)

Part B defines the quality targets that it is envisaged to reach. Lot of work is on-going concerning the establishment of sound targets. Most of the implementation, in particular concerning the non-mandatory targets, is expected from 2018.

The quality targets are distinguished between mandatory and non- mandatory targets. This latter are expected to generate new recommendations[5].

3.2.1 Mandatory targets (compliance targets)

Seven targets derived from the BR Regulation have been established in 2016 and used for the assessment in 2016 and 2017.

3.2.2 Non-mandatory targets

Non mandatory targets for NSBRs and for EGR can be derived in different ways as described here after.

[5] Recommendations are defined as non-mandatory suggestions or proposals as to the best course of action.

- NSBRs targets from the BR Regulation – Although they would improve the SBRs quality, some of the provisions in the BR Regulation are optional. They concern some characteristics of the SBRs and the exchange of information.

- NSBRs targets derived from good practices –It is planned setting up a catalogue of good practices of NSBRs production and dissemination processes. MS being recognized for their expertise and experience in specific domains will be asked to provide descriptions of their practices.

- EGR targets from the ESBRs[6] Business Case – Some quality targets for the EGR are clearly fixed in the ESBRs business case in terms of coverage (matching the FATS population). Eurostat plans achieving a very good coverage for FATS purposes already in 2018.

- NSBRs and EGR targets from the EGR quality indicators - Three types of quality indicators are calculated for the EGR process: input, throughput (process) and output indicators. More detailed EGR quality targets based on the analyses of these indicators' results are expected by 2018. Input indicators will generate targets for the NSBRs. Throughput and output indicators will generate targets for the EGR.

- NSBRs and EGR targets derived from users' needs – The first general user needs consultation was conducted in 2017 and its results will help in formulating further targets for the 2018 DQP cycle. These needs should be monitored regularly.

3.3 Part C – Quality assessment (measuring the gap)

The quality assessment is based on the difference between the current state and the targets.

The assessment is executed for each quality target after the annual reporting phase. For the moment is based only on the analysis of the mandatory targets. Eurostat plans starting using also non-mandatory targets for the 2018 assessment.

All results are documented in country specific assessment reports for NSBRs and a report assessing the EGR. All assessment reports are for SBRs-internal purpose only (they are not public).

3.3.1 NSBRs assessment for mandatory targets

From 2016 Eurostat assesses the NSBRs quality reports against six minimum targets derived from the BR Regulation. A seventh target (still derived from the BR Regulation) is assessed on the basis of information from the EGR process. For each target points are allocated as shown in picture 3.

[6] "European System of interoperable statistical Business Registers" project

Total scores for each country are calculated. They range from 0 (fully non-compliant NSI) to 100 (fully compliant NSIs).

Targets	'SHALL' Article in Reg. 177/2008	Assessment criteria	Weight for overall result
1. Mandatory characteristics provided in NSBR	Annex	0% missing characteristics	40
2. Enterprise as statistical unit is implemented	Art. 2	Yes/No	10
3. Annual updates of entries and removals	Art. 8 (1)	Yes/No	10
4. Annual copy reflects the state at end of a year	Art. 8 (4)	Yes/No	10
5. MS carry out statistical analyses of the NSBR	Art. 9 (1)	Yes/No	5
6. MS transmit at request information with regards to implementation of Reg. 177/2008	Art. 9 (2)	Yes/No	5
7. MS transmits mandatory data for the purpose of the EGR according to Reg. 192/2009	Art. 11 (1) Art. 11 (3)	0% missing characteristics	20

Picture 3 *– Criteria and weights for the assessment of the NSBRs minimum quality targets*

The assessment allows a rapid monitoring of:

- the compliance by country for a given year;
- the progress by country (comparison between consecutive years).

After the initial assessment, Eurostat contacts the Member States bilaterally in order to clarify any possible misunderstanding and to agree on an action plan for countries reaching low scores, i.e. low compliance with the BR Regulation.

Finally Eurostat prepares the annual compliance report, taking into account the bilateral clarifications and the action plans to reach the compliance.

In 2017 Eurostat is further investigating the compliance concerning the implementation of the statistical unit "enterprise".

3.3.2 NSBRs assessment for recommendations (non-mandatory targets)

Concerning the assessment of the recommendations it is planned to elaborate the criteria in time for the 2018 DQP cycle.

3.3.3 EGR assessment

Concerning the EGR assessment it is planned to elaborate the criteria in time for the 2018 DQP cycle. The results of the 2015 EGR cycle scoreboard are detailed in chapter 4.3 of this document.

3.4 Part D – Quality improvement (reducing the gap)

Part D deals with the coordination of the annual improvement actions aiming at:

- improving the NSBRs compliance with respect to the BR Regulation standards (compliance - mandatory targets);
- improving the overall quality of the NSBRs and of the EGR (recommendations – non-mandatory targets).

3.4.1 Improving the compliance (minimum NSBRs quality)

Eurostat follows-up the annual compliance report which describes the causes for non-compliance.

Specific actions have been taken in 2016 and even more in 2017 to improve the understanding of the national situations and of the plans towards the full compliance.

3.4.2 Improving the NSBRs and EGR quality

In general, to achieve gradually improvements in the SBRs quality and converging to the quality targets as defined in part B of the DQP, existing processes and/or methodology shall be reviewed, discussed and wherever possible optimized or improved.

The annual improvement process is organised around the "Improvement Plan", which lists some "improvement actions". These actions are aspects of the SBRs production (including NSBRs and EGR processes) to be discussed in short/medium term. The Improvement Plan has been established in 2015 and it is regularly discussed and revised in the ESS.

Each year two or three improvement actions are selected and discussed in details in order to formulate agreed recommendations for improving the current practice.

At present the Improvement Plan contains nine actions, addressing the NSBRs and the EGR. Two of these actions were already discussed and the corresponding recommendations were agreed. Another two actions were selected and the discussion will start in the last quarter of2017.

These recommendations will be part of the revised SBRs Recommendations Manual[7].

In the coming years the Improvement plan should mainly result from the non-mandatory targets set in the second DQP component (to-be state).

[7] In 2017 Eurostat launched an action for the full revision of the Recommendations Manual by 2019

On top of the general SBRs Improvement plan, Eurostat defined an action plan for the EGR development in 2017 and 2018. This action plan is fitting to milestones for EGR in the period 2017-2020 set in the road map of the ESBRs Business Architecture and it almost fully covers the EGR targets derived from the 2017 user needs consultation.

4 EGR data quality with a view to FATS statistics

Any improvement in the NSBRs quality and interoperability will also be beneficial for the EGR quality. Moreover actions to reduce the gap with the EGR coverage targets fixed by the ESBRs business case are on-going.

*4.1 **Results of 2015 cycle** (released in March 2017)*

For reference year 2015 the EGR produced a final picture on 80 thousand multinational enterprise groups. The 80 thousand groups cover 778 thousand legal units and 640 thousand enterprises.

The recently implemented EGR quality indicators show that EGR 2.0 mostly was able to process the input data for the 2015 cycle as expected. The output data of EGR 2015 were mostly defined by the input data. The indicators show that output results were heavily impacted where low numbers of cross-border relationships were received from the sources.

In the data only few issues were discovered where input data was not processed as expected, and this had impact on the output. Eurostat has been working to solve these issues already for the 2015 cycle as far as possible. Where this was not possible, actions will be taken during the 2016 cycle.

4.2 Coverage compared to FATS

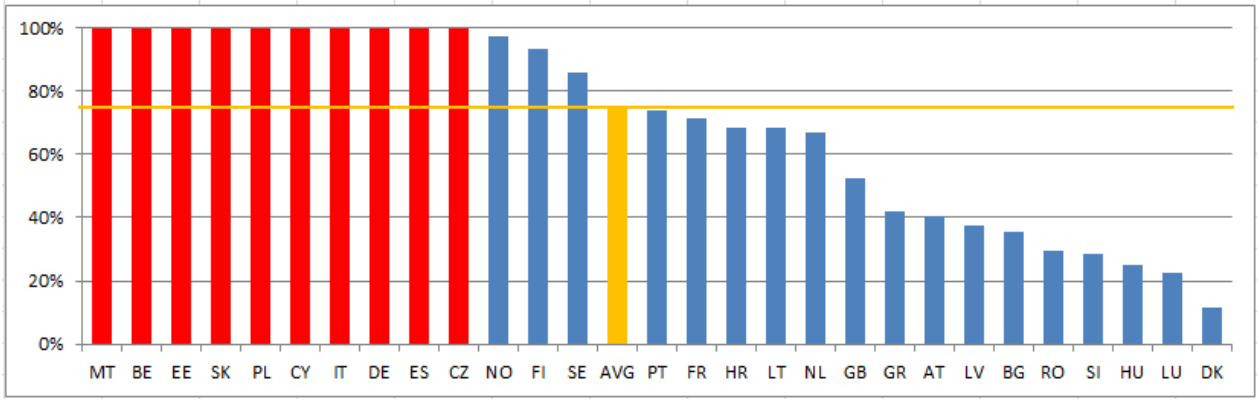
Eurostat made global comparisons on the 2015 EGR Frame coverage. The number and employment of foreign controlled enterprises in EGR 2014 and 2015 were compared to the foreign controlled enterprises of the 2014 IFATS data (2015 data will be published later). From EGR only the enterprises of activities presented in FATS were selected.

The comparison shows that the EGR coverage significantly increased from 2014 to 2015. **EGR 2015 covers 75 % of the IFATS enterprises**; this was 55 % for 2014, based on a comparison on total numbers.

As the red columns of Picture 4 shows for large number of the EU countries the EGR covers more foreign controlled enterprises in total than published in IFATS. *(For better visibility the data in Pictures 4 and 5 are only displayed until 100 %.).*

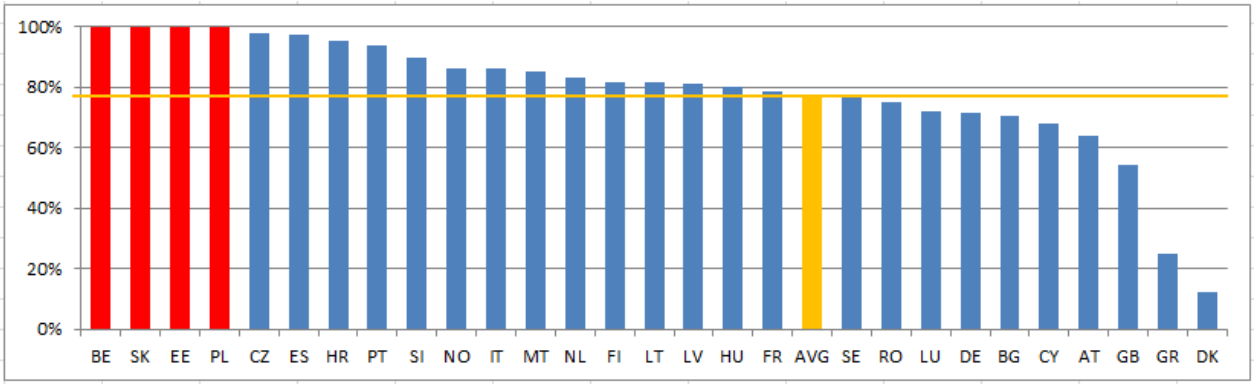
The comparison of employment of the enterprises shows that **EGR 2015 covers 78 % of the IFATS employment** (Picture 5). This was 71 % for 2014, based on a comparison on total numbers.

EGR 2015 (B-N_S95_X_K) / IFATS 2014



Picture 4 *- EGR 2015 coverage compared to IFAT, number of enterprises*

EGR 2015 (B-N_S95_X_K) / IFATS 2014



Picture 5 *- EGR 2015 coverage compared to IFATS, employment of enterprises*

4.3 EGR quality indicators

More appropriate comparisons can be made in the coming period on the EGR and FATS populations with the new EGR output quality indicators.

As soon as 2015 FATS data will be published, NSIs will be requested to compare on enterprise record level the 2015 national IFATS / OFATS populations to the EGR 2015 frame.

- IFATS 1 Completeness of EGR
- IFATS 2 Accuracy of UCI in EGR
- IFATS 3 Completeness of EGR on employment
- IFATS 4 Completeness of IFATS from EGR perspective
- OFATS 1 Completeness of EGR UCIs

Some of these output quality indicators were calculated by few NSIs for the 2014 EGR cycle (Picture 6). As we can see from the global numbers, in addition to the EGR process also the EGR completeness improved from reference year 2014 to 2015; therefore the 2015 indicators are expected to show better results.

Indicator	Indicator	AT	BG	DE	IT	RO	SI
IFATS 1	Completeness of EGR	0.46	0.21	0.56	0.69	0.53	0.23
IFATS 2	Accuracy of UCI in EGR	0.82	0.99	0.84	0.76	0.98	0.85
OFATS 1	Completeness of EGR UCIs	0.63	0.35	0.03	0.47	0.43	0.40

***Picture 6** – EGR output quality indicators of the EGR 2014 cycle*

In addition to the output quality indicators Eurostat will continue calculating input and throughput quality indicators for the EGR process. Where appropriate, threshold will be also defined for the quality indicators in 2018.

4.4 Scoreboard for NSIs contribution

To support NSIs in improving the national data exchange process with EGR Eurostat prepared a scoreboard measuring the NSI contribution to the EGR 2015 cycle. The measurement is done on information on file deliveries to EGR and on completeness of input files.

This is the first version of such scoreboard; it should be fine-tuned in the future, especially to be able to distinguish between compliance in the EGR data exchanges and additional quality monitoring (e.g. timeliness of deliveries, completeness of input).

The target of the current scoreboard is providing feedback to NSIs, showing in which areas they have to improve to reach full quality contribution to EGR. NSIs can identify on which data exchange they have to focus to improve their contribution. The current scoreboard cannot measure the completeness of NSI data files compared to target population (FATS populations); this can be done by quality indicators.

Elements of the 100-point EGR scoreboard are as follows:

- Delivery of resident legal unit file to the EGR Identification service (yes=15, no=0)
- Delivery of non-resident to the EGR Identification service (yes=15, no=0)
- Delivery of data files to EGR CORE on legal units, relationships and enterprises in time (yes, before deadline=20, yes, with delay=10, no=0)
- Delivery of cross-border relationships to EGR CORE (yes=10, few (<100)=2, no=0)
- Delivery of foreign subsidiaries to EGR CORE (yes=5, few (<100)=1, no=0)
- Completeness of main activity code, employment and turnover in the enterprise data (1 to 10 depending on completeness of these key variables)
- Delivery of relationships in the group validation phase (yes=15, no=0)
- Data to EGR CORE on groups (yes=10, no=0)

The scoreboard data (Picture 7)provide feedback to NSIs to identify the areas where they have to improve to be complete in the EGR contributions.

Based on the results of the scoreboard NSI specific recommendations were defined and sent to the NSIs in view of the 2016 EGR cycle. Table 3 presents the results of the 2015 EGR scoreboard.

Complete, timely and better quality contribution of all NSIs to the EGR 2016 cycle will help to improve the output of the EGR 2016 frame.

Country code	EGR IS res (15)	EGR IS non- res (15)	LEU REL ENT (20)	Cross-border RELs (10)	For. subs. (5)	ENT compl. (10)	Repair RELs (15)	Group data (10)	EGR 2015 total
AT	15	15	20	10	5	6	15	10	96
BE	15	15	20	10	5	7	15	10	97
BG	15	15	20	10	5	10	15	10	100
CH	15	15	10	10	5	6	0	0	61
CY	15	15	20	10	0	6	15	0	81
CZ	15	15	10	10	5	5	15	10	85
DE	15	15	20	10	0	4	0	0	64
DK	15	15	20	0	0	5	15	0	70
EE	15	15	20	10	5	7	15	10	97
ES	15	15	20	10	0	10	15	10	95
FI	15	15	10	10	5	10	0	10	75
FR	15	15	10	10	5	10	15	10	90
GB	15	15	20	10	5	10	0	0	75
GR	15	0	0	0	0	2	0	0	17
HR	15	15	10	10	5	10	15	10	90
HU	15	15	20	10	5	10	15	10	100
IE	15	15	10	2	0	4	0	0	46
IS	15	0	0	0	0	3	0	0	18
IT	15	15	10	10	5	5	15	10	85
LI	0	0	0	0	0	6	0	0	6
LT	15	15	20	10	5	10	15	10	100
LU	15	15	20	10	5	7	15	10	97
LV	15	15	20	10	5	10	15	10	100
MT	15	15	20	10	0	10	15	10	95
NL	15	0	20	10	0	7	15	10	77
NO	15	15	20	10	1	10	15	10	96
PL	15	15	20	10	5	6	15	10	96
PT	15	15	20	10	5	10	15	10	100
RO	15	15	20	10	0	5	15	10	90
SE	15	15	20	10	1	10	15	10	96
SI	15	15	20	10	5	10	15	10	100
SK	15	15	20	10	5	4	15	10	94

1-25 | 26-50 | 51-75 | 76-100

Picture 7 – *EGR scoreboard results for the 2015 cycle*

4.5 EGR action plan for 207 and 2018

The ESBRs Business Architecture Task Force specified a road map for the ESBRs developments of national registers, EGR and profiling. Milestones were defined for EGR in the period 2017-2020, covering EGR process improvements, increase in the coverage, accuracy and timeliness.

Eurostat prepared an action plan, detailing how to improve the EGR in 2017 and 2018. A preliminary version of the action plan was commented by the NSIs. The updated version will be presented under item 6 of this meeting. Led by the action plan, Eurostat and the NSIs will continue working on improving EGR process and EGR quality.

5 The publication of some EGR aggregates as a tool for quality improvement

Following discussions in different ESS fora, Eurostat proposed publishing an article with aggregated data tables on multinational enterprise groups. The data tables present the structure of the multinational enterprise groups in the EU and EFTA countries. Tables are based on EGR data of reference year 2015. Eurostat proposed publishing the aggregated data tables on the Eurostat's Statistics Explained website as experimental statistics.

As other Eurostat experimental statistics publications, the article would be published in a dedicated and separate section of the Eurostat website where users are made aware of the experimental character of the information released. Moreover the information would be marked with the experimental statistics logo and accompanied by methodological notes, explaining that these statistics have not reached full maturity in terms of harmonization, coverage or methodology.

The main goal of this initiative is to seek feedback and stimulate discussions with producers (i.e. European NSIs) and with users (mainly but not only European NSIs) on the future scope of MNE group statistics, on applied definitions and classifications.

Potential quality issues that could be highlighted through the users' comments include the following: EGR coverage, MNE group perimeters (units which are part of the groups), group characteristics, allocation of global decision centers of the groups.

6 Conclusions and plans for the near future

The Data Quality Program for the Statistical Business Registers in the European Statistical System is reaching maturity and starts delivering results.

The process is already quite well implemented and is expected producing relevant benefits for the whole system of European SBRs in the coming years.

In particular it is planned to gradually insert in the quality process detailed targets for the non-mandatory requirements, as well as improvement actions based on the non-mandatory targets and on their assessment. This is expected having a relevant impact on the quality and the interoperability of the system of European SBRs.

Concerning EGR, any improvement in the NSBRs quality and interoperability will also be beneficial for the EGR quality.

Moreover, if the targets for EGR quality on which Eurostat is working with the support of the Europeans NSIs will be respected, by 2018 EGR is expected to be well fit for FATS purposes: it should cover all IFATS units and all OFATS UCIs and should contain validated GDC (Global Decision Center) information for all large groups[8] in Europe; timeliness should also improve.

Plans to serve other users than FATS will be analyzed in the coming years and will introduce new quality challenges.

The monitoring of the users' needs through the DQP will allow taking the right decisions on the future actions for quality improvement both for the NSBRs and for the EGR.

[8] 2500 and more employees