# European Innovation Scoreboard and its application to Russia & Ukraine

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# Outline

- What is EIS?
- Conceptual framework
- Indicators
- Method of calculation
- Application to Russia and Ukraine (?)

# EIS: a composite indicator (26)

- Innovation is a non-linear process and the EIS indicators are distributed among five categories that cover different key dimensions of innovation performance.
- Not all countries perform on the same level in each of these dimensions and some countries may even prove to be especially weak in one or several dimensions of innovation
- ***Innovation Inputs:***
  - Innovation drivers (5 indicators),
  - Knowledge creation (5 indicators),
  - Innovation & entrepreneurship (6 indicators)
- **Innovation Outputs:**
  - Application (5 indicators)
  - Intellectual property (5 indicators)

# Conceptual framework: inputs and outputs I

## Innovation Input

- **Innovation drivers**, to measure the structural conditions required for innovation potential
- **Knowledge creation**, to measure the investments on human factors and on R&D activities, considered as the key elements for a successful knowledge based economy
- **Innovation & entrepreneurship**, to measure the efforts towards innovation at the microeconomic level

# Conceptual framework: inputs and outputs II

## Innovation Output

- **Application**, to measure the performance, expressed in terms of labour and business activities, and their value added in innovative sectors
- **Intellectual property**, to measure the achieved results in terms of successful know how, especially referred to high-tech sectors.

# INPUT - Innovation drivers

- 1.1 New S&E graduates per 1000 population aged 20-29
  - Everything from 1 year BA to PhD
- 1.2 Population with tertiary education per 100 population aged 25-64
- 1.3 Broadband penetration rate (number of broadband lines per 100 population).
- 1.4 Participation in life-long learning per 100 population aged 25-64
  - Availability for RUS/UKR (??)
- 1.5 Youth education attainment level (% of population aged 20-24 having completed at least upper secondary education)
  - Supply of human capital of that age group

# INPUT - Knowledge creation

- 2.1 Public R&D expenditures (% of GDP)
- 2.2 Business R&D expenditures (% of GDP)
- 2.3 Share of medium-high-tech and high-tech R&D (% of manufacturing R&D expenditures)
- 2.4 Share of enterprises receiving public funding for innovation
  - Source: Innovation survey. Availability for RUS/UKR(??)
- 2.5 Share of university R&D expenditures financed by business sector

# INPUT - Innovation & entrepreneurship

- 3.1 SMEs innovating in-house (% of SMEs)
  - All large enterprises innovate
  - Source: Innovation survey > Availability for RUS/UKR (??)
- 3.2 Innovative SMEs co-operating with others (% of SMEs)
  - All large enterprises are involved in cooperation
  - Source: Innovation survey > Availability for RUS/UKR (??)
- 3.3 Innovation expenditures (% of turnover)
  - Source: Innovation survey > Availability for RUS/UKR (??)
- 3.4 Early-stage venture capital (% of GDP)
  - Dynamism of new business creation (?): seed and start ups
  - 2 year average due to fluctuations; MBO are excluded
  - Availability for RUS/UKR (??)
- 3.5 ICT expenditures (% of GDP)
- 3.6 SMEs using non-technological change (% of SMEs)
  - Source: Innovation survey > Availability for RUS/UKR (??)

# OUTPUT - Application

- 4.1 Employment in high-tech services (% of total workforce)
  - Telecom (NACE64), IT (NACE72) and R&D (NACE73)
- 4.2 Exports of high technology products as a share of total exports
  - OECD classification
- 4.3 Sales of new-to-market products (% of turnover)
  - Source: Innovation survey > Availability for RUS/UKR (??)
- 4.4 Sales of new-to-firm not new-to-market products (% of turnover)
  - Proxy for degree of diffusion of state of the art technology
  - Source: Innovation survey > Availability for RUS/UKR (??)
- 4.5 Employment in medium-high and high-tech manufacturing (% of total workforce)
  - Eurostat-OECD classification

# OUTPUT - Intellectual property

- 5.1 New EPO patents per million population
- 5.2 New USPTO patents per million population
- 5.3 New Triad patents per million population
  - Source: OECD
- 5.4 New community trademarks per million population
  - Comparability of the EU and RUS/UKR (?)
  - Source for RUS/UKR
- 5.5 New community industrial designs per million population
  - Comparability of the EU and RUS/UKR (?)
  - Source for RUS/UKR

# Method of calculation

- Equal weighting for all indicators
- Re-scaling method:
  - the lowest country value = 0; the highest country value = 1 within the EU25 + 3 + Rus/Ukr
  - The SII is calculated as the average value of all re-scaled values
  - See next slide
- Normalisation to be based on relative to EU25
- Relative to EU25 data are calculated as the ratio between the most recent data for a country and the value of the EU25 in that same year
- Not imputation for missing data (Alternative: econometric estimation in case of time series?)

# Re-scaling method

Each indicator $x_{ic}^{t}$ for a generic country c and time t is transformed in

$I_{ic}^{t} = \frac{x_{ic}^{t} - min_c(x_i^t)}{max_c(x_i^t) - min_c(x_i^t)}$ where $min_c(x_i^t)$ and $max_c(x_i^t)$ are the minimum and the maximum value of $x_{ic}^{t}$ across all the countries $c$ at time t. In this way, the normalized indicators $I_{ic}$ have values laying between 0 (laggard, $x_{ic}^{t} = min_c(x_i^t)$) and 1 (leader, $x_{ic}^{t} = max_c(x_i^t)$). The re-scaling normalizes indicators to have an identical range, in this case (-0.5;0.5). This range has been selected to maintain the symmetry around zero as in the z-scores method.

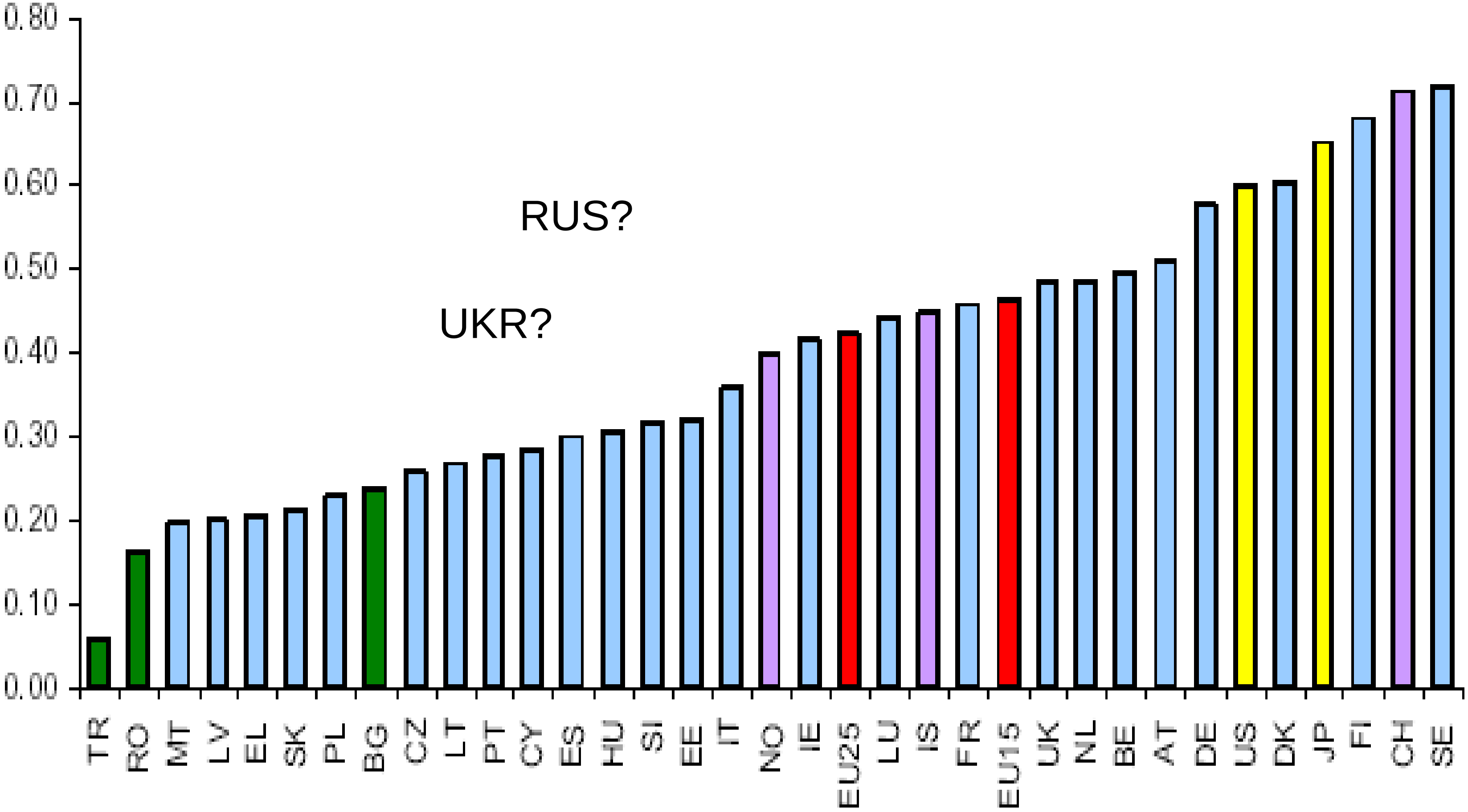
# Calculation of trends

- Trends are calculated as the annual percentage change between the last year for which data are available and the average over the preceding three years, after a one-year lag.
- The three-year average is used to reduce year-to-year variability; the one-year lag is used to increase the difference between the average for the three base years and the final year and to minimize the problem of statistical/sampling variability.
- For example, when the most recent data are for 2004, the trend is based on the percentage change between 2004 and the average for 2000 to 2002 inclusive. The results for 2003 are excluded in order to provide a one-year lag.
- For years T, T-1 and T-2 a summary innovation index is calculated using the MinMax-approach but using maximum and minimum values over the 3-year period;

# Calculation of trends – handling missing data

- No imputation for missing data in T;
- For the 7 indicators based on CIS-3 data in T-1 and T-2 are assumed to be identical to the values in year T;
- “Imputation” for missing data at T-1 and T-2 by assuming identical values to those in T respectively T-1.

# THE 2005 SUMMARY INNOVATION INDEX (SII)



# Issues for Russian and Ukrainian Innovation Scoreboards I

- Data availability for at least one year (2005?)
- Availability of time series to calculate trends (5 years as a minimum) (?)
- Treatment of missing data

# If available data are too limited we will have to follow alternative procedure as applied for TR, US and JP

- Step 1) For all 33 countries an SII is calculated using only data for the 19 non-CIS indicators, thus excluding indicators 2.4, 3.1, 3.2, 3.3, 3.6. 4.3 and 4.4.
- Step 2) A simple regression for the EU25 countries, Iceland, Norway, Switzerland, Bulgaria and Romania was run with the SII from Step 1 as the dependent variable and the 2005 SII as the independent variable.
- Step 3) The parameter values from Step 2 were then used to compute a 2005 SII estimate for TR, US and JP by substituting the value as computed in Step 2 in the regression equation as follows: SII = (computed SII - 0.059)/0.8564.