

Measuring EU performance on the Small Business Principles- Methodology

MICHAELA SAISANA

European Commission Joint Research Centre (Ispra, Italy)

4th October 2011

Executive Summary

The development of the 2011 SBA Fact Sheets moved from a one-way design process of the previous versions to an iterative process with the JRC with a view to laying the foundation for a balanced tool. This report presents the refinements made and provides an additional assessment of the conceptual/statistical coherence in the final tool.

The JRC analysis suggests that the approach undertaken by DG ENTR in quantifying the SBA Principles for the EU Member States is statistically and conceptually coherent and that the SBA principles are indeed multidimensional (the underlying indicators capture very diverse aspects with little or no overlap of information between them). Country classifications (for 21 up to 26 EU Member States) with respect to the EU average in all principles are also fairly robust to methodological changes related to the estimation of missing data, normalization, weighting or aggregation rule.

Finally, the statistical qualities of an overall aggregate of the ten principles were explored: there seem to be three latent dimensions in the nine principles over 2005-2011 (the Environment was not considered due to limited data availability), hence simply calculating an average of the principles for each country would not be recommended. Instead, it maybe worthy attempting to interpret the latent dimensions for eventual policy actions (one dimension is composed of: “Think Small First”, “Responsive administration”, “Access to finance”, “Skills and Innovation” and “Internationalisation”; a second dimension is composed of: “Entrepreneurship”, “Second chance”, “Responsive administration”, also included in the first latent dimension, and “Single Market”; “State aid & Public Procurement” comes up as standalone dimension).

The Small Business Act (SBA) principles represent the EU flagship SME policy initiative on issues related to Entrepreneurship, State Aid, Single Market and others. Quantifying these complex concepts with single numbers, as envisaged by DG ENTR in the *SBA Fact Sheets*, may raise practical challenges: the selection of indicators, the quality of data, and the statistical combination of these into a model. Yet, if done properly, the exercise could yield a useful tool capable of monitoring the implementation of the SBA at national level, with the potential to identify eventual problems, and contribute to priority setting and policy formulation.

The assessment of conceptual and statistical coherence of the *2011 SBA Fact Sheets* and the estimation of the impact of the modeling assumptions on a country's performance are necessary steps. They ensure the transparency and reliability of the *SBA Fact Sheets* and enable policymakers to derive more accurate and meaningful conclusions.

The *2011 SBA Fact Sheets* were assessed along two main avenues: the conceptual and statistical coherence of their structure, and the impact of key modelling assumptions on the EU Member States scores.

Audit by the Joint Research Centre of the European Commission

The Unit of Econometrics and Applied Statistics at the European Commission Joint Research Centre (JRC) in Ispra (Italy) has researched extensively on the complexity of composite indicators ranking countries' performances along policy lines¹ and has authored – together with the Organisation for Economic Co-operation and Development (OECD), a *Handbook on Constructing Composite Indicators: Methodology and User Guide*, whose methodology has been used for the present analysis.

For the 2011 edition, the JRC agreed to perform a thorough robustness and sensitivity analysis of the *SBA Fact Sheets*. The recommendations and flexibilities allowed on the basis of the JRC audit were taken into account in the final version of the *SBA Fact Sheets* and are explained below as appropriate.

SBA Fact Sheets - Framework

The SBA relies on ten principles: (1) Entrepreneurship, (2) Second chance, (3) Think small first, (4) Responsive administration, (5) State aid & Public procurement, (6) Access to finance, (7) Single market, (8) Skills & Innovation, (9) Environment, and (10) Internationalization. In creating the *2011 SBA Fact Sheets*, DG ENTR populated these principles with relevant indicators based on literature review and consultation with experts.

Table 1 lists the selected indicators, their direction, and the weights attached to them. “High” direction implies that higher values are desirable, and “Low” direction implies that lower values are desirable. For example, higher values are desired in the Share of SMEs with intra-EU exports, but low values in the Single Market directives not transposed or notified. For the time being, only one indicator –Innovations with environmental benefits– was selected as suitable for capturing some aspects of the principle on “Environment”. Summarizing an entire SBA principle with a single indicator is not recommended, hence it was decided that the principle on the “Environment” will not be assessed this year, but when more relevant indicators are available. The most populated principles are “Access to Finance” and “Skills and Innovation” with roughly 10 indicators each; the least populated principles are “Second Chance” and “Think Small First” with 3 indicators each.

Raw data values were normalized into the [0, 100] range, with higher scores representing better performance. Normalization was made according to the min-max method, where the min and max values were given by the minimum and maximum indicator values across all available years (2005-2011). The following formula was applied:

- For indicators with “High” direction

$$newvalue_t = 100 \times \frac{(oldvalue_t - \min_{2005-2011})}{(\max_{2005-2011} - \min_{2005-2011})}$$

- For indicators with “Low” direction:

$$newvalue_t = 100 \times \frac{(\max_{2005-2011} - oldvalue_t)}{(\max_{2005-2011} - \min_{2005-2011})}$$

Regarding the weights, all indicators within a principle receive equal weights, the only exception being the case of the principles “Skills & Innovation” and “Internationalisation”, where some indicators receive a weight of 1/3 or 1/2 (due to high collinearity, which is explained later).

A country’s score on an SBA principle is calculated as the weighted average of the underlying (normalised) indicators². Progress rates per country and principle were also calculated over 2005-2011. For the country comparison in the most recent year, and in order to evidence differences between countries, the 0-100 scale was applied for that dataset.

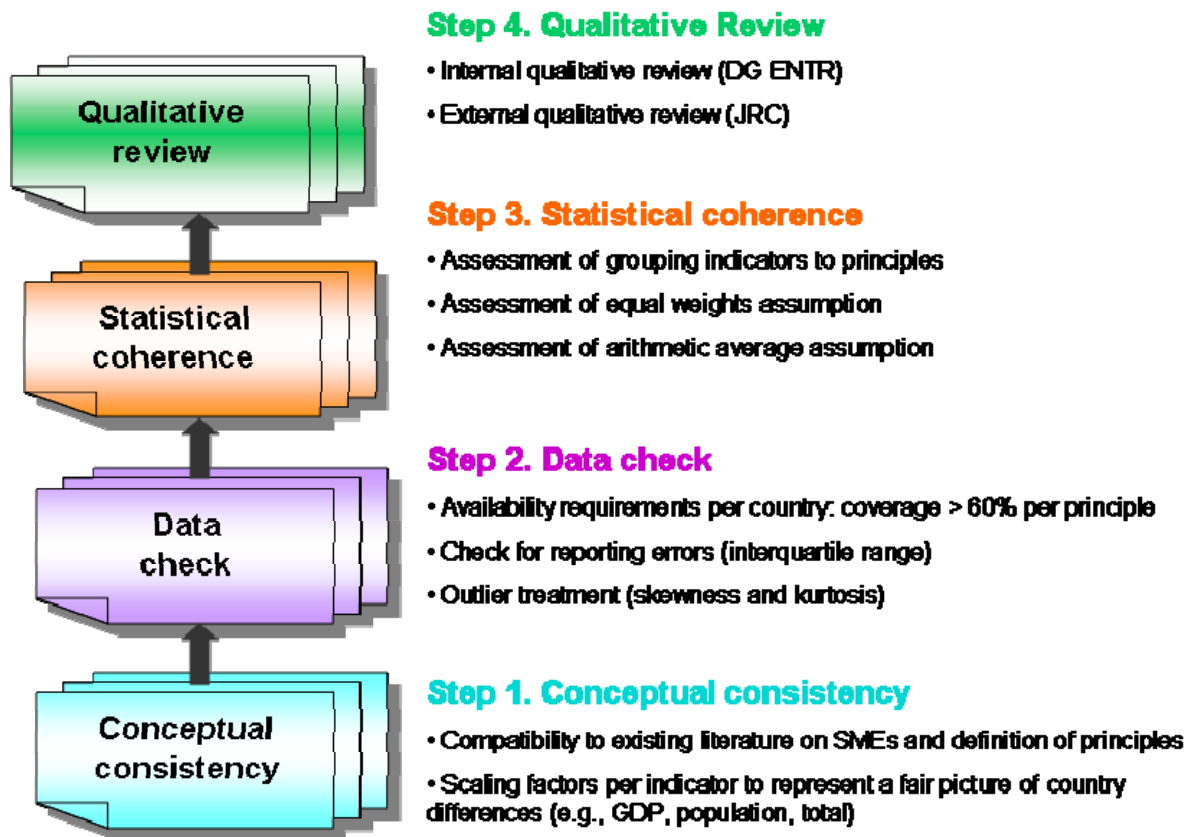
Table 1. 2011 Framework for the estimation of the ten SBA principles

SBA Principle	Indicator	Weights within principle	Direction
1. ENTREPRENEURSHIP	1.1 Degree to which school education helped develop an entrepreneurial attitude (%)	1	High
	1.2 Entrepreneurship rate (%)	1	High
	1.3 Opportunity entrepreneurship (%)	1	High
	1.4 Feasibility of becoming self-employed (%)	1	High
	1.5 Preference for self employment (%)	1	High
	1.6 Entrepreneurial intention (%)	1	High
	1.7 High status successful entrepreneurship (%)	1	High
	1.8 Media attention for entrepreneurship (%)	1	High
2. SECOND CHANCE	2.1 Time to close business (years)	1	Low
	2.2 Cost to recover debt (% of debtor's estate)	1	Low
	2.3 Degree of support for allowing for a second chance (%)	1	High
3. THINK SMALL FIRST	3.1 Licenses and permits systems	1	Low
	3.2 Communication and simplification of rules and procedures	1	Low
	3.3 Burden of government regulation	1	High
4. RESPONSIVE ADMINISTRATION	4.1 Time to start a business (calendar days)	1	Low
	4.2 Cost required to start a business (% of income per capita)	1	Low
	4.3 Paid in minimum capital (% of income per capita)	1	Low
	4.4 Time required to transfer property (calendar days)	1	Low
	4.5 Cost required to transfer property (% of property value)	1	Low
	4.6 Number of tax payments per year	1	Low
	4.7 Time required to comply with major taxes (hours per year)	1	Low
	4.8 Cost to enforce contracts (% of claim)	1	Low
	4.9 Full online availability of the basic 8 public services to businesses	1	High
5. STATE AID & PUBLIC PROCUREMENT	5.1 SME's share in the total value of public contracts awarded	1	High
	5.2 State aid for SMEs (% of total aid)	1	High
	5.3 Average delay in payments (from public authorities)	1	Low
	5.4 e-Procurement availability (pre-award)	1	High
6. ACCESS TO FINANCE	6.1 Venture capital investments - early stage (% of GDP)	1	High
	6.2 Planned share of EU Structural Funds dedicated to stimulating entrepreneurship and SMEs in 2007-2013 (% of total allocation by MS)	1	High
	6.3 Planned share of EAFRD dedicated to measures 312 "Support for business creation and development" in 2007-2013 (% of total allocation)	1	High
	6.4 Strength of legal rights	1	High
	6.5 Depth of credit information	1	High
	6.6 Total duration to get paid (no. of days)	1	Low
	6.7 Lost payments (% of total turnover)	1	Low
	6.8 Difference in interest rate levels between loans up to EUR 1 million and loans over EUR 1 million	1	Low
	6.9 Share of bank loan applications by SMEs that were not successful (Rejected loan applications and loan offers whose terms and conditions were deemed unacceptable as % of all loan applications)	1	Low
	6.10 Access to public financial support including guarantees (% that indicated a deterioration)	1	Low
	6.11 Willingness of banks to provide a loan (%share that indicated a deterioration)	1	Low
7. SINGLE MARKET	7.1 Average transposition delay for overdue directives (in months)	1	Low
	7.2 Number of 2 years overdue directives	1	Low
	7.3 Single market directives not transposed or notified (%)	1	Low
	7.4 Share of SMEs with intra-EU exports (%)	1	High
	7.5 Share of SMEs with intra-EU imports (%)	1	High
8. SKILLS & INNOVATION	8.1 SMEs innovating in-house (% of SMEs)	0.33333333	High
	8.2 Innovative SMEs collaborating with others (% of SMEs)	1	High
	8.3 SMEs introducing product or process innovations (% of SMEs)	0.33333333	High
	8.4 SMEs introducing marketing or organizational innovations (% of SMEs)	0.33333333	High
	8.5 Sales of new to market and new to firm innovations (% of turnover)	1	High
	8.6 SMEs participating in EU funded research (number per 100.000 SMEs)	1	High
	8.7 SMEs selling online (% of SMEs)	0.5	High
	8.8 SMEs purchasing online (% of SMEs)	0.5	High
	8.9 Training enterprises (% of all enterprises)	1	High
	8.10 Employees' participation rate in education and training (% of total no of employees for units with maximum 10 employees)	1	High
9. ENVIRONMENT	9.1 Innovations with environmental benefits	1	High
10. INTERNATIONALISATION	10.1 Number of documents required to export	1	Low
	10.2 Time required to export	0.5	Low
	10.3 Cost required to export	1	Low
	10.4 Number of documents required to import	1	Low
	10.5 Time required to import	0.5	Low
	10.6 Cost required to import	1	Low
	10.7 SMEs exporting outside the EU (% of SMEs)	1	High
	10.8 SMEs importing from outside the EU (% of SMEs)	1	High

Conceptual and statistical coherence in the measurement of the SBA principles

The development of the 2011 SBA Fact Sheets moved from a one-way design process to an iterative process with the JRC with a view to laying the foundation for a balanced tool. This section will consider these refinements and provide an additional assessment of the conceptual/statistical coherence in the final tool. The entire process followed four steps (see Figure 1):

Figure 1. Conceptual and statistical coherence in the 2011 SBA Fact Sheets



Step 1: Conceptual consistency

Candidate indicators were selected for their relevance to a specific SBA principle (based on literature review and expert opinion) and for their timeliness. To represent a fair picture of country differences, indicators were scaled (e.g., by number of SMEs, total turnover, or other units) as appropriate and where needed.

Step 2: Data checks

The most complete time series data were considered for each country, with a cut-off at year 1999. All countries considered were: the EU27 countries plus Albania, Croatia, FYROM, Iceland, Israel, Liechtenstein, Montenegro, Norway, Serbia and Turkey. Country scores for a given principle were calculated only if data availability was at least 60% in that principle.³ Data values outside the 2.0 interquartile range were checked for reporting errors.⁴ Potentially problematic indicators that could bias the overall results were identified as those having a skewness (absolute) greater than 2 and kurtosis greater than 3.5,⁵ and were treated by winsorisation (where country values distorting the indicator distribution were assigned the next highest value, up to the level where skewness and kurtosis entered within the specified ranges).⁶ A further data quality issue relates to the treatment of missing values. In past versions of the Fact Sheets, DG ENTR had opted not to impute missing data, but instead to calculate country scores per principle by averaging only the available country values. Although this approach can be a good starting point, it has notable shortcomings, as we discuss further. For the 2011 release, a more suitable imputation approach that combines multiple imputation with trend analysis (time-series-cross-sectional imputation) was carried out by the JRC and adopted by DG ENTR. The imputation details will be discussed in more detail later on when assessing the impact assessment of other modeling assumptions.

Step 3: Statistical coherence

Few cases of strong collinearity (i.e., Pearson correlation coefficients greater than ~ 0.90 across most of the years analysed) were spotted.⁷ These involved indicators 8.1 with 8.3 and 8.4, 8.7 with 8.8, and 10.2 with 10.5 (see Table 1 for a description of the indicators). For

all indicators, this issue was dealt with by treating the pair or triplet as a single indicator (by assigning half, or one-third, weight to each normalized score).

Principal component analysis confirms that the SBA principles are indeed multidimensional and the underlying indicators capture very diverse aspects with little overlap of information between them. The first latent dimension in each principle captures only between 25% and 50% of the variance of the underlying indicators (more variance explained in the more homogenous principles, namely “Single Market”, “Skills and Innovation” and “Internationalisation”). A more detailed analysis of the correlation structure within and across the SBA principles confirms the expectation that the indicators are more correlated to their own principle than to any other principle and all correlations, when significant, they have the expected sign (see example in Table 2). This result has two implications: from a statistical point, no-reallocation of the indicators into different principles is needed, and no trade-offs are present in this dataset as all significant correlations are positive, pointing to the same direction.

In most principles, the underlying indicators have similar correlation coefficients to the overall principle, which implies that the equal weighting approach is enough to guarantee an equal contribution of the indicators to the variance of the scores in the respective principle. In few cases, though, as for the “Single Market” (see Table 3), not all indicators have the same degree of association with the Single Market scores. This remark remains more of statistical nature and is meant to shed more light and transparency on the number crunching in the development of the SBA Fact Sheets. Should one aim for an equal contribution of the indicators to the overall variance of the principle scores, then the weight assigned to the Share of the SMEs with intra-EU imports and exports should be slightly higher than one-fifth (as it is the case now).

Table 2. Example of coherence test for the Second Chance indicators: Correlation with all SBA principles

	P1	P2	P3	P4	P5	P6	P7	P8	P10
2.1 Time to close business (years)	0.05	0.72	0.41	0.48	-0.18	0.20	-0.01	0.52	0.41
2.2 Cost to recover debt (% of debtor's estate)	0.06	0.75	0.44	0.55	-0.17	0.24	-0.02	0.55	0.51
2.3 Degree of support for allowing for a second	0.32	0.55	-0.25	0.09	0.32	-0.03	0.15	-0.11	0.11

Table 3. Example of coherence test for the Single Market indicators: Correlation of indicators with their own principle

	Single Market
7.1 Average transposition delay for overdue directives (in months)	0.83
7.2 Number of 2 years overdue directives	0.75
7.3 Single market directives not transposed or notified (%)	0.70
7.4 Share of SMEs with intra-EU exports (%)	0.47
7.5 Share of SMEs with intra-EU imports (%)	0.46

The statistical properties of an overall aggregate score of the ten principles were explored. It is not recommended to combine the nine principles together by calculating an average for the following reasons. There are three latent dimensions in the nine principles, but the grouping is different from year to year (see Table 4, Table 5). For the pooled dataset in 2005-2011, the first latent dimension is described by “Think Small First”, “Responsive administration”, “Access to finance”, “Skills and Innovation” and “Internationalisation” (explaining altogether 35% of the variance). The second latent dimension is described by “Entrepreneurship”, “Second chance”, “Responsive administration” (also included in the first latent dimension), and “Single Market” (explaining 17% of the variance). Finally, the third latent dimension is captured by “State aid & Public Procurement” (14% of the variance explained). Provided that a meaningful interpretation of these latent dimensions can be made by the relevant experts on the field, there might be an added value in producing three simple averages for each of these dimensions. In that case, an equal weighting approach would be justifiable, given that the principles have very similar loadings on the respective dimensions.

Table 4. Principal Components Analysis results for 2005-2011: grouping of principles

Dataset in 2005-2011	PC1	PC2	PC3
1. Entrepreneurship			
2. Second chance			
3. Think small first			
4. Responsive administration			
5. State aid & public procurement			
6. Access to finance			
7. Single market			
8. Skills & Innovation			
10. Internationalisation			
Explained variance (% total)	35%	19%	14%

Table 5. Principal Components Analysis results for the most recent year: grouping of principles

Dataset - most recent	PC1	PC2	PC3
1. Entrepreneurship			
2. Second chance			
3. Think small first			
4. Responsive administration			
5. State aid & public procurement			
6. Access to finance			
7. Single market			
8. Skills & Innovation			
10. Internationalisation			
Explained variance (% total)	40%	17%	14%

Step 4: Qualitative Review

Finally, the 2011 SBA Fact Sheets results were evaluated by DG ENTR together with the Members of the EU Working Group on SMEs and Entrepreneurship to verify that the overall results are, to a great extent, consistent with current evidence or existing research.

Notwithstanding these statistical tests and the positive outcomes on the statistical coherence of the 2011 SBA Fact Sheets structure, it is important to mention that this tool will continue to evolve as better data, more assessments, and new relevant research studies become available.

Impact of modeling assumptions on the SBA results

Every country score on an SBA principle is the outcome of a number of choices: the ten-pillar structure, the indicators selected, the estimation or not of missing data, the normalization of the indicators, the weights assigned to them, and the aggregation method, among other elements. Some of these choices are based on the opinion of experts in the field (e.g., selection of indicators and equal weighting within principle), or common practice (e.g., min-max method to normalise the indicators), driven by statistical analysis (e.g., averaging pairs of highly collinear indicators prior to the final aggregation step) or simplicity (e.g., no estimation of missing data for the previous versions of the SBA Fact Sheets). The aim of the robustness analysis is to assess to what extent these choices might impact the main messages communicated in the 2011 SBA Fact Sheets. We have dealt with these uncertainties in order to check their simultaneous and joint influence on the results, with a view to better understand their implications. In the present analysis the data are assumed to be error-free since DG ENTR already undertook a double-check control of potential outliers (identified as 2 times above or below the interquartile range for each indicator in the initial dataset covering 1999-2011). Errors and typos were corrected during this stage (see Step 2 in Figure 1).

The robustness assessment of the *2011 SBA Fact Sheets* was based on a combination of a Monte Carlo experiment and a multi-modelling approach. This type of assessment aims to respond to eventual criticism that the country scores associated with aggregate measures are generally not calculated under conditions of certainty, even if they are frequently presented as such.⁸ The Monte Carlo simulation related to the issue of weighting and comprised 1 000 runs, each corresponding to a different set of weights of the indicators underlying the nine principles, randomly sampled from uniform continuous distributions centred in the reference values ($\pm 25\%$ of the reference value). The choice of the range for the weights' variation has been driven by two opposite needs: on the one hand, the need to ensure a wide enough interval to have meaningful robustness checks; on the other hand, the need to respect the rationale of the SBA Fact Sheets that the indicators are placed on equal footing when building an SBA principle scores. Given these considerations, limit values of uncertainty intervals have been defined as shown in Table 6.

The multi-modelling approach involved combinations of the remaining three key assumptions on the impact of the missing data, the normalisation method and the aggregation formula. In past versions of the SBA Fact Sheets, for reasons of transparency and replicability, missing data were not estimated; instead principle scores were calculated using only available information for each country. This ‘no imputation’ choice, which is common in relevant contexts, might discourage countries from reporting low data values.⁹ To overcome this limitation, we opted to use multiple imputation (time-series-cross-sectional imputation) and we created ten “complete datasets” with this method.¹⁰ Regarding the normalisation method (min-max) which is commonly applied in similar contexts of aggregate measures but which may eventually impact the results due to the fact that the indicators have different variances, we tested the z-scores method that entails subtracting the mean and dividing by the standard deviation for each indicator. Finally, regarding the assumption on the aggregation function (arithmetic average) decision-theory practitioners have challenged this type of aggregation because of inherent theoretical inconsistencies and because of the fully compensatory nature, in which a comparative high advantage of a few variables can compensate a comparative disadvantage of many variables.¹¹ Hence, we considered the geometric average instead,¹² which is a partially compensatory approach.

Consequently, we tested 40 models based on the combination of the imputed values, min-max versus z-scores normalisation, or arithmetic versus geometric average. Combined with the 1,000 simulations per model to account for the uncertainty in the weights for the indicators, we carried out altogether 40,000 simulations for each principle.

Table 6. Simulated uncertainties in the SBA Fact Sheets

I. Uncertainty in the imputed values			
Ten "complete" datasets after applying time-series-cross sectional imputation			
II. Uncertainty in the weights			
<i>SBA Principle</i>	<i>Reference value</i>	<i>Uncertainty range</i>	
1. Entrepreneurship (8)	0.125	0.094	0.156
2. Second chance (3)	0.333	0.250	0.417
3. Think small first (3)	0.333	0.250	0.417
4. Responsive administration (9)	0.111	0.083	0.139
5. State aid & Public procurement (4)	0.250	0.188	0.313
6. Access to finance (11)	0.091	0.068	0.114
7. Single market (5)	0.200	0.150	0.250
8. Skills & Innovation (7)	0.143	0.107	0.179
10. Internationalization (7)	0.143	0.107	0.179
III. Uncertainty in the normalisation			
	<i>Reference</i>	<i>Alternative</i>	
	min-max	z-scores	
IV. Uncertainty in the aggregation formula			
	<i>Reference</i>	<i>Alternative</i>	
	arithmetic average	geometric average	

Uncertainty analysis results

An important remark is that the uncertainty results, to be discussed here, can not inform on the quality of the framework underpinning the SBA principles; this was already done in the first part of the analysis. Instead, the results in this section can only provide information on the validity of inferences associated with the country scores for the principles. Note further that country scores related to more dimensional measures, such as the SBA principles, are more sensitive to the methodological assumptions than country scores related to aggregate measures that are built of highly correlated indicators (as for lifelong learning and governance phenomena).

Country scores on each of the nine principles were calculated combining the assumptions on missing data estimation, normalisation method, weights, and aggregation formula. Results for selected countries are shown next. For each country and SBA principle

the relative position with respect to the EU average and the simulated probabilities are shown. Countries “close to the EU average” are those that score $\pm \frac{1}{2}$ st.deviation near the EU average. Countries “above the EU average” are those that score more than $\frac{1}{2}$ st.deviation of the EU average, and vice versa for those “below the EU average”.

Austria, for example, on “Entrepreneurship” is classified on the *2011 SBA Fact Sheets* as being close to the EU average, and this is confirmed in 85% of the simulated cases. However, its classification on “Second Chance” as being also close to the EU average is questionable, given that this is the case only in 42% of the simulations (below the EU average in the remaining 58% of the simulations). This result was expected given the profile of Austria in the three indicators underlying the Second Chance principle (one indicator above, one below and one close to the average, see Figure 3).

Another example is Denmark, whose classification as “below the EU average” performance on Entrepreneurship is confirmed in 100% of the simulated cases (see Figure 4 and Figure 5).

Italy’s classification on the State Aid & Public procurement is not clear. Despite the close to the EU average performance according to the SBA Fact Sheets, the simulated results show that Italy could also be below or even above the EU average (though most likely below the EU average, see Figure 6 and Figure 7).

Overall, country classifications (above/close/below EU average) in the *2011 SBA Fact Sheets* are supported by the simulations (60 to 100% probability) and these classifications are fairly robust (for 21 up to 26 EU Member States) to methodological changes related to the estimation of missing data, normalization, weighting or aggregation method.

Figure 2. Probabilistic assessment of Austria for the SBA principles

Austria		Probabilistic assessment wrt to the EU average		
		SBA Fact Sheet	Below	Close to
1. Entrepreneurship	Close to EU	15%	85%	0%
2. Second chance	Close to EU	58%	42%	0%
3. Think small first	Above EU	0%	0%	100%
4. Responsive administration	Below EU	90%	10%	0%
5. State aid & Public procurement	Above EU	0%	0%	100%
6. Access to finance	Close to EU	0%	65%	35%
7. Single market	Below EU	71%	29%	0%
8. Skills & Innovation	Above EU	0%	0%	100%
10. Internationalization	Close to EU	0%	100%	0%

Figure 3. SBA Fact Sheet results for Austria (all principles, Second Chance)

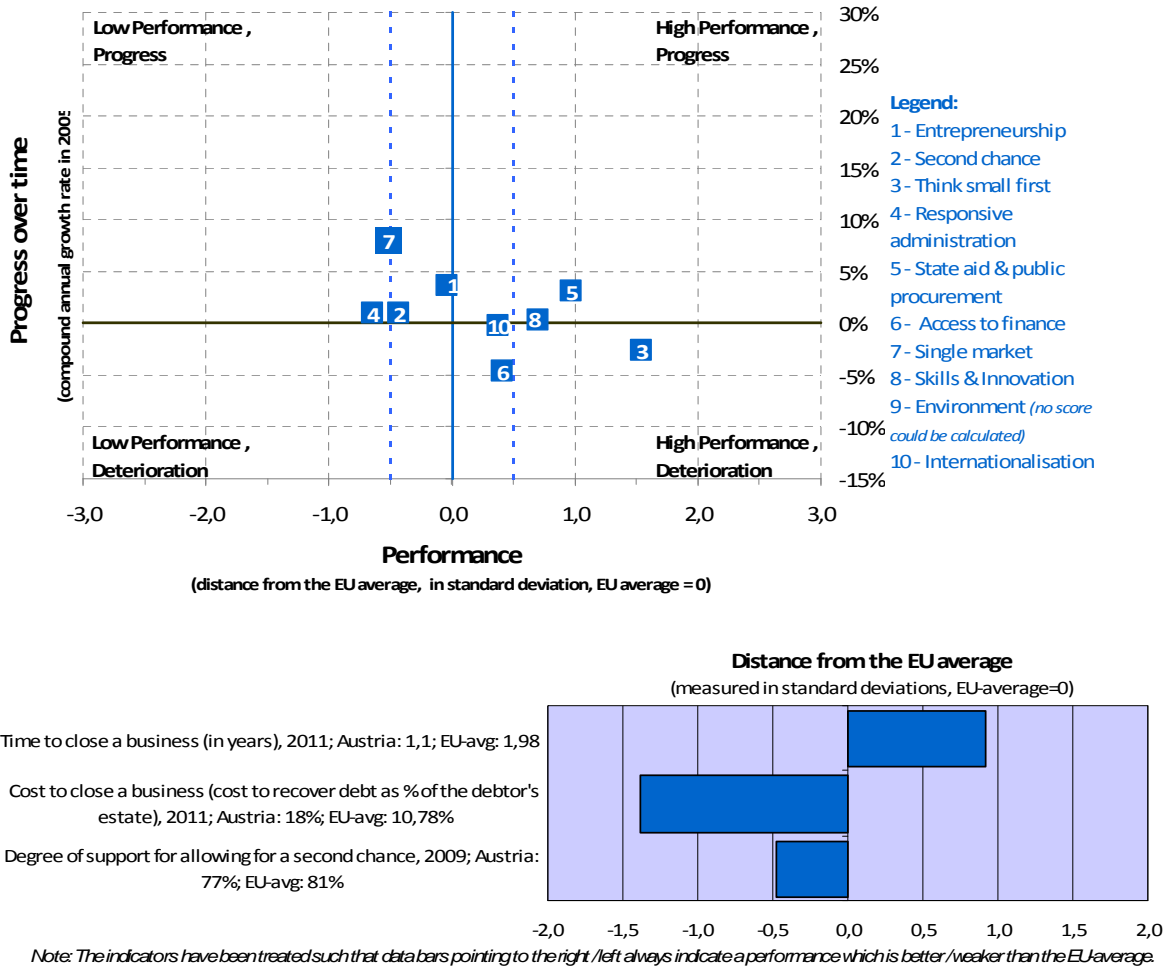


Figure 4. Probabilistic assessment of Denmark for the SBA principles

Denmark		<i>Probabilistic assessment wrt to the EU average</i>		
		<i>SBA Fact Sheet</i>	<i>Below</i>	<i>Close to</i>
1. Entrepreneurship	Below EU	100%	0%	0%
2. Second chance	Above EU	0%	28%	72%
3. Think small first	Above EU	0%	0%	100%
4. Responsive administration	Above EU	0%	0%	100%
5. State aid & Public procureme	Above EU	21%	45%	33%
6. Access to finance	Above EU	8%	60%	31%
7. Single market	Above EU	0%	0%	100%
8. Skills & Innovation	Above EU	0%	0%	100%
10. Internationalization	Above EU	0%	0%	100%

Figure 5. SBA Fact Sheet results for Denmark (all principles, Entrepreneurship)

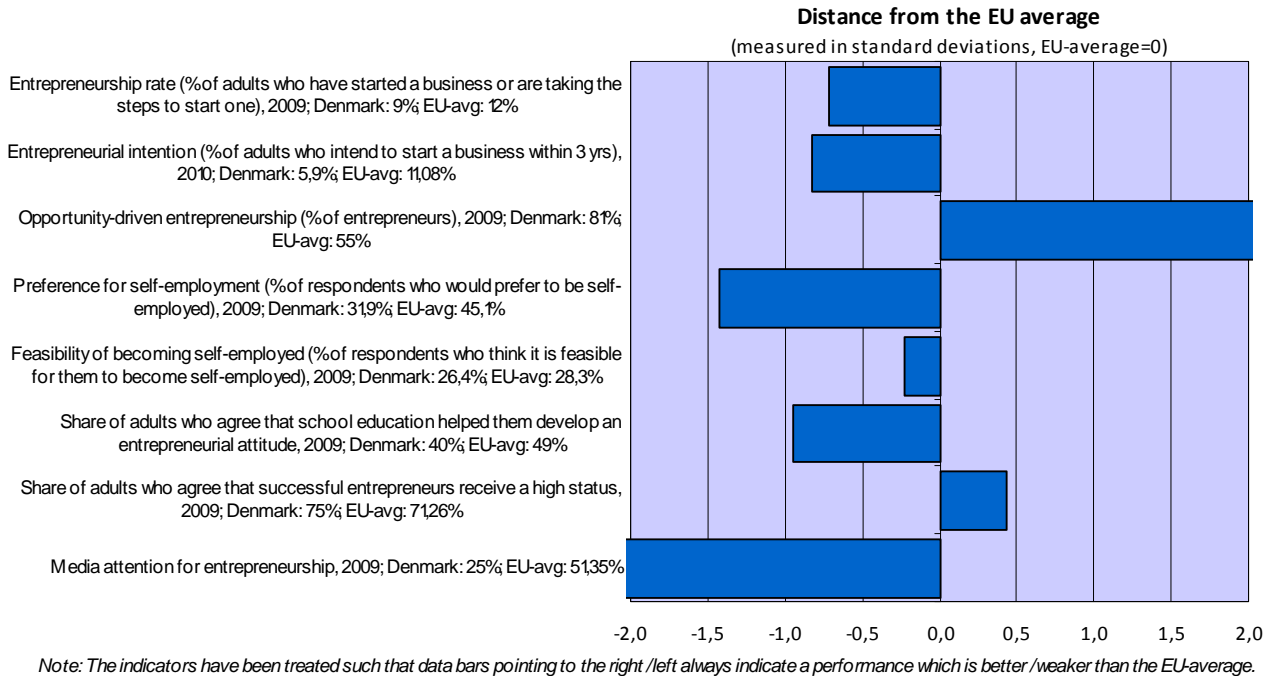
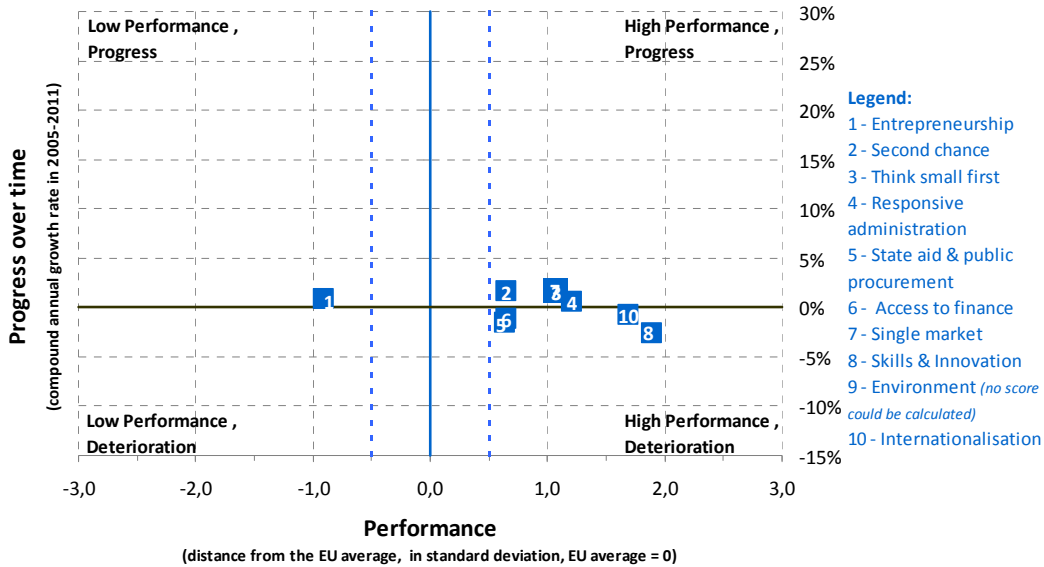
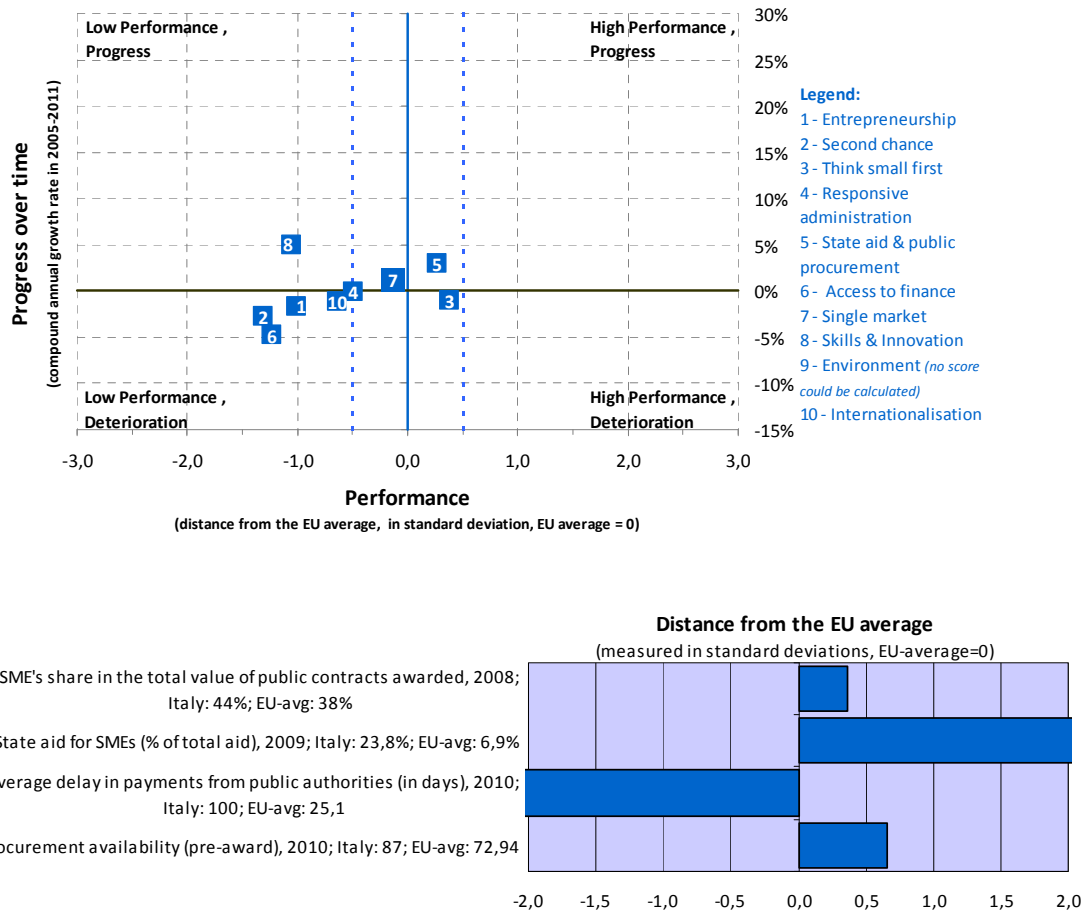


Figure 6. Probabilistic assessment of Italy for the SBA principles

Italy	Probabilistic assessment wrt to the EU average			
	SBA Fact Sheet	Below	Close to	Above
1. Entrepreneurship	Below EU	100%	0%	0%
2. Second chance	Below EU	100%	0%	0%
3. Think small first	Close to EU	25%	60%	15%
4. Responsive administration	Close to EU	70%	30%	0%
5. State aid & Public procurement	Close to EU	48%	32%	20%
6. Access to finance	Below EU	100%	0%	0%
7. Single market	Close to EU	24%	76%	0%
8. Skills & Innovation	Below EU	100%	0%	0%
10. Internationalization	Below EU	97%	3%	0%

Figure 7. SBA Fact Sheet results for Italy (all principles, State Aid & Public procurement)



Note: The indicators have been treated such that data bars pointing to the right/left always indicate a performance which is better/weaker than the EU average.

Sensitivity analysis

Complementary to the uncertainty analysis, sensitivity analysis has been used to identify which of the modeling assumptions have the highest impact on country classification. Results will be reported on the Final JRC report¹³.

Conclusion

The development of the 2011 SBA Fact Sheets moved from a one-way design process of the previous versions to an iterative process with the JRC with a view to laying the foundation for a balanced tool. This report has presented the refinements made and provided an additional assessment of the conceptual/statistical coherence in the final tool.

The JRC analysis suggests that the approach undertaken by DG ENTR in quantifying the SBA Principles for the EU Member States is statistically and conceptually coherent and that the SBA principles are indeed multidimensional (the underlying indicators capture very diverse aspects with little or no overlap of information between them). Country classifications (for 21 up to 26 EU Member States) with respect to the EU average in all principles are also fairly robust to methodological changes related to the estimation of missing data, normalization, weighting or aggregation rule.

Finally, the statistical qualities of an overall aggregate of the ten principles were explored: there seem to be three latent dimensions in the nine principles over 2005-2011 (the Environment was not considered due to limited data availability), hence simply calculating an average of the principles for each country would not be recommended. Instead, it maybe worthy attempting to interpret the latent dimensions for eventual policy actions (one dimension is composed of: “Think Small First”, “Responsive administration”, “Access to finance”, “Skills and Innovation” and “Internationalisation”; a second dimension is composed of: “Entrepreneurship”, “Second chance”, “Responsive administration”, also included in the first latent dimension, and “Single Market”; “State aid & Public Procurement” comes up as standalone dimension).

References

- Blackwell, Honaker, King, 2010. Multiple Overimputation: A Unified Approach to Measurement Error and Missing Data
- Groeneveld, R. A. and G. Meeden. 1984. 'Measuring skewness and kurtosis'. *The Statistician* 33: 391–99.
- Honaker, King, 2010, "What to do About Missing Values in Time Series Cross-Section Data", *American Journal of Political Science*.
- Little, R. J. A. and D. B. Rubin. 2002. *Statistical Analysis with Missing Data*, 2nd edition. Hoboken, NJ: John Wiley & Sons.
- OECD/EC JRC. 2008. Handbook on Constructing Composite Indicators: Methodology and User Guide. Paris: OECD.
- Saisana, M., B. D'Hombres, and A. Saltelli. 2011. 'Rickety Numbers: Volatility of University Rankings and Policy Implications'. *Research Policy* 40: 165–77.
- Saisana, M., Saltelli, A., Tarantola, S., 2005. Uncertainty and sensitivity analysis techniques as tools for the analysis and validation of composite indicators. *Journal of the Royal Statistical Society A* 168(2), 307-323.
- Saltelli, A., Ratto, M., Andres, T., Campolongo, F., Cariboni, J., Gatelli, D., Saisana, M., Tarantola, S. 2008. *Global Sensitivity Analysis: The Primer*. Chichester, England: John Wiley & Sons.

Endnotes

- ¹ JRC auditing studies of composite indicators are available at <http://composite-indicators.jrc.ec.europa.eu/> (almost all audits were carried upon request of the Index developers).
- ² Weights are scaled to unity sum.
- ³ Scores are not reported for: Malta on Second Chance; Bulgaria, Cyprus, Latvia, Lithuania Malta and Romania on Think Small First; Malta on Responsive Administration; Denmark and Greece on Environment; and Malta on Internalization.
- ⁴ The interquartile range is the difference between the upper (75% of values) and the lower (25% of values) quartiles.
- ⁵ Groeneveld and Meeden (1984) set the criteria for absolute skewness above 1 and kurtosis above 3.5. The skewness criterion was relaxed to account for the small sample.
- ⁶ Regarding the most recent year dataset, there was a single outlier value in four indicators: Number of tax payments per year included in Responsive administration), Average delay in payments from public authorities in State aid, Venture capital investments - early stage in Access to finance, and Share of SMEs with intra-EU exports in Single Market.
- ⁷ High collinearity can be problematic when analysing the statistical coherence of a framework and may result in aggregate scores that are dominated by the highly collinear indicators.
- ⁸ Saisana et al., 2005; Saisana et al., 2011.
- ⁹ Note that here ‘no imputation’ is equivalent to replacing missing values with the average of the available data within each principle.
- ¹⁰ The approach was proposed by a team of researchers at Harvard and has proven to work efficiently with various datasets and with different degrees of correlation among indicators, even in case of relatively important data gaps. Other methods of dealing with missing data, such as listwise deletion, mean substitution, or single imputation, are in common circumstances biased, inefficient, or both. When multiple imputation works properly, it fills in data in such a way as to not change any relationships in the data but which enables the inclusion of all the observed data in the partially missing rows. (see
- ¹¹ Munda, 2008.
- ¹² In the geometric average, pillars are multiplied as opposed to summed in the arithmetic average. Pillar weights appear as exponents in the multiplication.
- ¹³ The final JRC report will also include full uncertainty results for all countries and cluster analysis results. The report will be available online at <http://composite-indicators.jrc.ec.europa.eu/> on October 25th.