



European  
Commission

# JRC SCIENTIFIC AND POLICY REPORTS

## Monitoring SMEs' performance in Europe Indicators fit for purpose

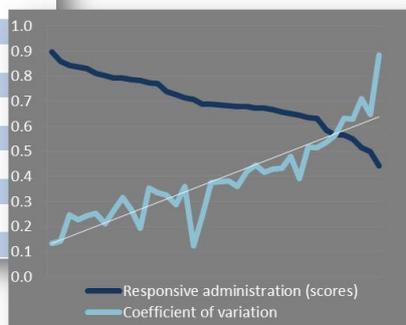
Methodological note

Michaela Saisana

2012

### Ten Principles of the Small Business Act

- I. Entrepreneurship
- II. Second chance
- III. Think small first
- IV. Responsive administration
- V. State aid and public procurement
- VI. Access to finance
- VII. Single market
- VIII. Skills and innovation
- IX Environment
- X. Internationalization



	Probabilistic assessment			
	SBA	Below EU	Close to EU	Above EU
Entrepreneurship ▲	0%	17%	84%	
Second chance ▲	0%	0%	100%	
Think small first ▲	0%	0%	100%	
Responsive administration ▲	0%	41%	59%	
State aid and public procurement ▲	0%	50%	50%	
Access to finance ▲	0%	0%	100%	
Single market ▬	0%	100%	0%	
Skills and innovation ▲	0%	0%	100%	
Environment ▲	0%	0%	100%	
Internationalization ▲	0%	0%	100%	

**European Commission**

Joint Research Centre

Institute for the Protection and Security of the Citizen

**Contact information**

Michaela Saisana

Address: Joint Research Centre, Via Enrico Fermi 2749, TP 361, 21027 Ispra (VA), Italy

E-mail: [michaela.saisana@jrc.ec.europa.eu](mailto:michaela.saisana@jrc.ec.europa.eu)

Tel.: +39 0332 78 6572

Fax: +39 0332 78 5733

<http://composite-indicators.jrc.ec.europa.eu/>

<http://www.jrc.ec.europa.eu/>

This publication is a Reference Report by the Joint Research Centre of the European Commission.

**Legal Notice**

Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use which might be made of this publication.

Europe Direct is a service to help you find answers to your questions about the European Union

Freephone number (\*): 00 800 6 7 8 9 10 11

(\*) Certain mobile telephone operators do not allow access to 00 800 numbers or these calls may be billed.

A great deal of additional information on the European Union is available on the Internet.

It can be accessed through the Europa server <http://europa.eu/>.

JRC 76107

EUR 25577 EN

ISBN 978-92-79-27202-8

ISSN 1831-9424

doi:10.2788/62756

Luxembourg: Publications Office of the European Union, 2012

© European Union, 2012

Reproduction is authorised provided the source is acknowledged.

Printed in Italy

## Table of Contents

Executive Summary.....	3
1. Introduction .....	5
2. SBA Fact Sheets - Framework.....	8
3. SBA Fact Sheets - Methodology.....	13
<i>Step 1: Selection of indicators and data checks</i> .....	13
<i>Step 2: Missing data</i> .....	14
<i>Step 3: Normalisation</i> .....	15
<i>Step 4: Weights</i> .....	15
<i>Step 5: Aggregation</i> .....	16
4. Conceptual and statistical coherence .....	17
<i>Principal component analysis and cross-correlation analysis</i> .....	17
<i>Assessment of the implicit weights</i> .....	19
<i>Ten SBA principles: one number?</i> .....	21
5. Impact of modeling assumptions on the SBA results.....	22
6. Key messages for Europe .....	39
<i>SBA principles – looking across them</i> .....	39
<i>SBA principles – looking within them</i> .....	40
7. Conclusions.....	42
8. References.....	46

## List of Tables

Table 1. SBA principles and rationale .....	8
Table 2. SBA Framework .....	10
Table 3. Variance explained the SBA principles and the principal components .....	18
Table 4. Example of coherence test in the Internationalization principle .....	18
Table 5. Implicit weights of the indicators in the ten SBA principles.....	20
Table 6. Principal Components Analysis results for the SBA principles.....	21
Table 7. Uncertainty parameters (missing values, normalization, weights and aggregation function).....	23
Table 8. SBA principles: Simulations for Austria, Belgium, Bulgaria.....	26
Table 9. SBA principles: Simulations for Cyprus, Czech Republic, Denmark.....	27
Table 10. SBA principles: Simulations for Estonia, Finland, France .....	28
Table 11. SBA principles: Simulations for Germany, Greece, Hungary.....	29
Table 12. SBA principles: Simulations for Ireland, Italy, Latvia.....	30
Table 13. SBA principles: Simulations for Lithuania, Luxembourg, Malta.....	31
Table 14. SBA principles: Simulations for Netherlands, Poland, Portugal.....	32
Table 15. SBA principles: Simulations for Romania, Slovakia, Slovenia.....	33
Table 16. SBA principles: Simulations for Spain, Sweden, United Kingdom .....	34
Table 17. SBA principles: Simulations for Albania, Croatia, FYROM.....	35
Table 18. SBA principles: Simulations for Iceland, Israel, Liechtenstein.....	36
Table 19. SBA principles: Simulations for Montenegro, Norway, Serbia .....	37
Table 20. SBA principles: Simulations for Turkey.....	38

## List of Figures

Figure 1. The distribution of country scores by SBA principle (most recent year) .....	40
Figure 2. SBA principles scores and the variability of their underlying indicators .....	41

## Executive Summary

The Small Business Act for Europe (SBA) reflects the Commission's political will to recognize the central role of SMEs in the EU economy and for the first time puts into place a comprehensive SME policy framework for the EU and its Member States. On an annual basis since 2008, the European Commission's Directorate-General for Enterprise and Industry (DG ENTR) produces the SBA country factsheets that serve as an additional source of information designed to improve evidence-based policy making, along ten established (COM(2008) 394 final) principles: (1) Entrepreneurship, (2) Second chance, (3) Think small first, (4) Responsive administration, (5) State aid and public procurement, (6) Access to finance, (7) Single market, (8) Skills and innovation, (9) Environment, and (10) Internationalization.

DG ENTR has operationalized these broad dimensions of SMEs achievement by populating them with three to nine indicators (per principle). For the 2012 release of the SBA factsheets, a total of 68 indicators were selected from 21 sources, including the Flash Eurobarometer on Entrepreneurship, the World Bank Doing Business, the OECD Product market regulations database, the European Payment Index, the European Central Bank database

on interest rates, and other. These ten dimensions are presented together but not aggregated into an overall index, as the focus is meant to be at the principles and their underlying indicators and not at a single number.

### Ten Principles of the Small Business Act

#### I. Entrepreneurship

#### II. Second chance

#### III. Think small first

#### IV. Responsive administration

#### V. State aid and public procurement

#### VI. Access to finance

#### VII. Single market

#### VIII. Skills and innovation

#### IX Environment

#### X. Internationalization

The JRC's Institute for the Protection and Security of the Citizen (IPSC) has calculated and analyzed the 2012 SBA dimensions based on in-house methodology in order to ensure their transparency and reliability. This should enable policymakers to derive more accurate and meaningful conclusions.

This report presents in detail the ten-dimensional framework of the SBA, the rationale behind each principle and the underlying indicators that were selected by DG ENTR after consultation with national experts. It discusses the methodological approach used to calculate the ten SBA principles. In brief, raw data are first checked for reporting errors and outliers

that could strongly bias the results are treated. Missing data are estimated using a time-series cross-sectional algorithm. The SBA principles are finally calculated as simple averages of the normalized (with min-max) indicators per country for 2007-2012 (whereby highly correlated indicators were counted as a single indicator. Compound annual growth rates are calculated per principle and country.

The statistical coherence of the SBA framework is assessed based on an analysis of the covariance structure within and across the principles. The analysis suggests that the SBA principles are indeed multidimensional and the underlying indicators capture very diverse aspects of SMEs achievements with little overlap of information between them. It also offers statistical arguments as to why the ten SBA principles should not be further aggregated into an overall index. The reason is that any aggregate measure of the ten SBA principles would only capture less than 37% of the total variance. Instead, it is interesting to study the “statistical” grouping of these ten principles into three latent dimensions: (a) Second chance, Think small first, Responsive administration, Skills and innovation and Environment, (b) State aid and public procurement, Access to finance, Single market, and Internationalization, and (c) Entrepreneurship. The added value from an analysis of these three latent dimensions

would only be derived provided that a meaningful interpretation of these latent dimensions can be made by the relevant experts on the field.

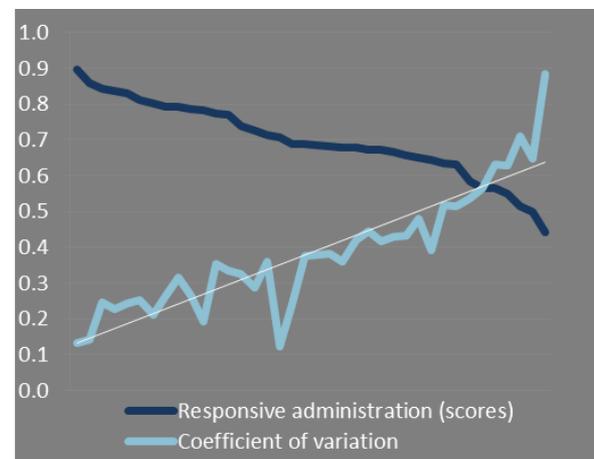
An additional analysis of the robustness of country classifications with respect to the EU average for each principle is undertaken with a view to examine to what extent the results depend on the selected set of indicators or on the methodological judgments made during the development of the SBA principles. For example, Finland performs above the EU average on eight principles and close to the EU average on one principle (Single market). These classifications are not a mere symptom of methodological judgments, but depend entirely on the selected indicators. On the other hand, Finland’s performance on State aid and public procurement is either close to or above the EU average depending on the methodological choices. Overall, country classifications with respect to the EU average in the 2012 SBA factsheets are supported by the simulations and these classifications are robust in 75% of the cases.

Probabilistic assessment					
Finland		SBA	Below EU	Close to EU	Above EU
Entrepreneurship	▲	0%	17%	84%	100%
Second chance	▲	0%	0%	100%	100%
Think small first	▲	0%	0%	100%	100%
Responsive administration	▲	0%	41%	59%	59%
State aid and public procurement	▲	0%	50%	50%	50%
Access to finance	▲	0%	0%	100%	100%
Single market	▬	0%	100%	0%	0%
Skills and innovation	▲	0%	0%	100%	100%
Environment	▲	0%	0%	100%	100%
Internationalization	▲	0%	0%	100%	100%

Extending the discussions offered in the 2012 SBA country factsheets, this report offers key messages on the European landscape of the SMEs achievements.

There is considerable differentiation among the SBA principles in terms of their dominant policy dynamics. On Responsive administration, Think small first and Access to finance, most countries are performing well; yet Greece could be considered as a hotspot on Access to finance. Contrarily, on Second chance, Single market, and Internationalization, the spread of countries' achievements is much wider. For issues related to these three principles, European policies need to find ways to spread best practices on SMEs already proven to work in some countries. Among other countries, best practices on Second chance are found in Finland, Ireland, and Norway. Similarly, best practices on Single market are found in Slovakia and Malta. On Internationalization, countries such as Denmark, Norway and Estonia can be studied for best practices. On State aid and public procurement, and Skills and innovation, most European countries have relatively poor scores. For these SBA principles, there is a compelling need to find policy processes that are transformational and that permit movement into achievements not currently prevalent in most European countries.

Countries with higher levels of SMEs performance in an SBA principle exhibit less variability, since they tend to achieve high values in most of the underlying indicators. The opposite holds generally true for countries with lower levels of achievement, which reflects the fact that countries with lower levels of achievement generally display larger discrepancies in performance between indicators, and that focusing only in particular indicators while allowing performance gaps between indicators yields only marginal results. This phenomenon is most evident on five SBA principles: Responsive administration, Think small first, Access to finance, Environment, and Internationalization.



The calculation of 2012 SBA principles has moved from a one-way design process of the previous versions to an iterative process with the JRC (since 2011) with a view to laying the foundation for a sound tool. This report has presented the refinements made and provided an additional assessment of

the conceptual/statistical coherence and uncertainty analysis in the final tool. Notwithstanding the statistical tests described above, it is important to mention

that the SBA framework will continue to be refined as better data, more assessments, and new relevant policy measures are implemented in Europe.

## 1. Introduction

The Small Business Act for Europe (SBA) reflects the Commission's political will to recognize the central role of SMEs in the EU economy and for the first time puts into place a comprehensive SME policy framework for the EU and its Member States. The SBA aims to improve the overall approach to entrepreneurship, permanently anchor the 'Think Small First' principle in policy making from regulation to public service, and to promote SMEs' growth by helping them tackle the remaining problems which hamper their development. The SBA<sup>1</sup> applies to all independent companies that have fewer than 250 employees: 99% of all European businesses. The SBA was endorsed politically by the EU Council of Ministers in December 2008<sup>2</sup> to ensure the full commitment of both the Commission and the Member States together with regular monitoring of its implementation.

On an annual basis, the European Commission issues the SMEs Performance Review, which includes the SBA country factsheets, compiled by the European Commission's Directorate-General for Enterprise and Industry (DG ENTR), in collaboration with the Joint Research Centre (JRC). These SBA country factsheets, serve as an additional source of information designed to improve evidence-based policy making, along the ten SBA principles: (1) Entrepreneurship, (2) Second chance, (3) Think small first, (4) Responsive administration, (5) State aid and public procurement, (6) Access to finance, (7) Single market, (8) Skills and innovation, (9) Environment, and (10) Internationalization. DG ENTR has operationalized these broad dimensions of SMEs achievement by populating them with three to nine indicators (per principle). These ten dimensions are presented together but not aggregated into an overall index, as the focus is meant to be at the principles and their underlying indicators and not at a single number.

---

<sup>1</sup> The symbolic name of an “Act” was given to this initiative to underline the political will to recognize the central role of SMEs in the EU economy and to put in place for the first time a comprehensive policy framework for the EU and its Member States.

<sup>2</sup> Brussels, 25.6.2008, COM(2008) 394 final, *Think Small First - A Small Business Act for Europe*, Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions.

The JRC's Unit of Econometrics and Applied Statistics has calculated and analyzed the 2012 SBA dimensions based on in-house<sup>3</sup> methodology in order to ensure their transparency and reliability. This should enable policymakers to derive more accurate and meaningful conclusions.

The report is structured as follows.

*Section 2* presents in detail the ten-dimensional framework of the SBA, the rationale behind each principle and the underlying indicators that were selected by DG ENTR after consultation with national experts. A total of 68 indicators were selected from 21 sources, such as Flash Eurobarometer on Entrepreneurship, World Bank Doing Business, OECD Product market regulations database, European Payment Index, European Central Bank database on interest rates, and other.

*Section 3* discusses the methodological approach used to calculate the ten SBA principles, related to data quality issues (missing data, eventual outliers), choice of normalization, weighting and aggregation formula. Raw data were first checked for reporting errors and outliers that could strongly bias the results were treated. Missing data were estimated using a time-series cross-sectional algorithm, proposed by a team of researchers at Harvard. The SBA principles were calculated as simple averages of the normalized (with min-max) indicators per country for 2007-2012 (whereby highly correlated indicators were counted as a single indicator).

*Section 4* analyzes the statistical coherence of the SBA framework based on an analysis of the covariance structure within and across the principles. The analysis suggests that the SBA principles are indeed multidimensional and the underlying indicators capture very diverse aspects of SMEs achievements with little overlap of information between them. It also offers statistical arguments as to why the ten SBA principles should not be further aggregated into an overall index.

*Section 5* assesses the robustness of country classifications with respect to the EU average for each principle, with a view to examine to what extent the results depend on the selected set of indicators or on the methodological judgments made during the development of the SBA principles. Overall, country classifications with respect to the EU average in the 2012 SBA

---

<sup>3</sup> The JRC analysis was based on the recommendations of the OECD (2008) Handbook on Composite Indicators, and on more recent research from the JRC implemented in numerous auditing studies of composite indicators available at <http://composite-indicators.jrc.ec.europa.eu/>

factsheets are supported by the simulations and these classifications are robust for 75% of the cases.

*Section 6* offers key messages on the European landscape of the SMEs achievements, beyond those already discussed extensively in the SBA country factsheets. It is found that there is considerable differentiation among the SBA principles in terms of their dominant policy dynamics. On Responsive administration, Think small first and Access to finance most countries are performing well; yet Greece could be considered as a hotspot on Access to finance. On State aid and public procurement and Skills and innovation most European countries have relatively poor scores. For these SBA principles, there is a compelling need to find policy processes that are transformational and that permit movement into achievements not currently prevalent in most European countries. Furthermore, while country scores on the SBA principles provide a quantitative indication of SMEs achievement, changes in the principles' variability convey information on the quality of the changes: an increase in SMEs performance may be achieved by improving performance in specific indicators, but also by reducing gaps in performance between indicators. Generally countries with higher levels of SMEs performance in an SBA principle exhibit less variability, since they tend to achieve high values in all the underlying indicators. The opposite holds generally true for countries with lower levels of achievement, see the trend. This reflects the fact that countries with lower levels of achievement generally display larger discrepancies in performance between indicators, and that focusing only in particular indicators while allowing performance gaps between indicators yields only marginal results.

*Section 7* provides a summary of the methods and the conclusions.

## 2. SBA Fact Sheets - Framework

The measurement of the SBA principles by DG ENTR is an evolving project since 2008. Every year's SBA country factsheets builds upon previous editions while refined with newly available data and inspired by the latest research and policy information on the measurement of SMEs performance in Europe. The SBA profiles are calculated for the 27 EU Member States and 10 non-Member States<sup>4</sup> which also contribute to the EU's Competitiveness and Innovation Framework Programme. The SBA profiles are developed along 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. Table 1 lists the ten SBA principles and offers the rationale, as this is described in the relevant Commission Communication (COM(2008) 394 final).

**Table 1. SBA principles and rationale**

SBA Principle	Rationale (from COM(2008) 394 final)
<b>I. Entrepreneurship</b>	To create an environment in which entrepreneurs and family businesses can thrive and entrepreneurship is rewarded
<b>II. Second chance</b>	To ensure that honest entrepreneurs who have faced bankruptcy quickly get a second chance
<b>III. Think small first</b>	To design rules according to the "Think Small First" principle
<b>IV. Responsive administration</b>	To make public administrations responsive to SMEs' needs
<b>V. State aid and public procurement</b>	To adapt public policy tools to SME needs: facilitate SMEs' participation in public procurement and better use State Aid possibilities for SMEs
<b>VI. Access to finance</b>	To facilitate SMEs' access to finance and develop a legal and business environment supportive to timely payments in commercial transactions
<b>VII. Single market</b>	To help SMEs to benefit more from the opportunities offered by the Single Market
<b>VIII. Skills and innovation</b>	To promote the upgrading of skills in SMEs and all forms of innovation
<b>IX Environment</b>	To enable SMEs to turn environmental challenges into opportunities
<b>X. Internationalization</b>	To encourage and support SMEs to benefit from the growth of markets

<sup>4</sup> The ten non-EU countries are: Albania, Croatia, FYROM, Iceland, Israel, Liechtenstein, Montenegro, Norway, Serbia and Turkey.

In the 2012 release of the SBA factsheets, each principle is composed of individual indicators, for a total of 68 indicators selected by DG ENTR in consultation with national experts. A total of 21 sources of information have been used. These sources are: the Flash Eurobarometer on Entrepreneurship, the Global Report (GEM), the World Bank Doing Business, the OECD Product market regulations database, the Global Competitiveness Report, the European Commission Directorate General for Information Society and Media database, the DG ENTR study on “Evaluation of SME’s access to public procurement markets in the EU”, the State aid scoreboard, the European Payment Index, the European Central Bank database on interest rates, the Eurostat report on Venture Capital, the European Commission Directorate General for Regional Policy database on EU funds, the European Commission Directorate General for Agriculture and Rural Development database on EAFRD funds, the Comext database on imports/exports, the Internal market scoreboard, the Eurostat Community Innovation Survey, the European Commission Directorate General on Research database CORDA, the Eurostat Information society indicators, CVT survey and labour force survey. Table 2 lists the 68 indicators underlying the 2012 SBA profiles.

The first principle on **Entrepreneurship** is captured by nine indicators, measuring self-employment, entrepreneurship rate, entrepreneurial intention, opportunity-driven entrepreneurship, preference for self-employment, feasibility of becoming self-employed, share of adults who agree that school education helped them develop an entrepreneurial attitude, share of adults who think that successful entrepreneurs receive a high status in the society, and finally media attention for entrepreneurship.

The second principle on **Second Chance** is described by three indicators, time and cost to close a business, and degree of support for a second chance.

The third principle on **Think Small First** is built by three indicators that describe communication and simplification of rules and procedures, burden of government regulations, and licenses and permits systems.

The fourth principle on **Responsive Administration** expands on nine indicators, measuring time and cost to start a business, paid in minimum capital, time and cost required to transfer property, number of tax payments per year, time required to comply with major taxes, cost to enforce contracts, and full online availability of the basic public services to businesses.

**Table 2. SBA Framework**

<p><b>I. Entrepreneurship</b></p> <p>1.1 Self-employment rate (% of total employment)</p> <p>1.2 Entrepreneurship rate (% adults who have started a business or are taking the steps to start one)</p> <p>1.3 Entrepreneurial intention (% adults who intend to start a business within 3 years)</p> <p>1.4 Opportunity-driven entrepreneurship (% of entrepreneurs)</p> <p>1.5 Preference for self-employment (% of adults who would prefer to be self-employed)</p> <p>1.6 Feasibility of becoming self-employed (% of adults who think it is feasible to become self-employed)</p> <p>1.7 Share of adults who agree that school education helped them develop an entrepreneurial attitude(%)</p> <p>1.8 Share of adults who think that successful entrepreneurs receive a high status in the society(%)</p> <p>1.9 Media attention for entrepreneurship (%)</p>	<p><b>VI. Access to finance</b></p> <p>6.1 Rejected loan applications and loan offers (% of loan applications by SMEs)</p> <p>6.2 Access to public financial support including guarantees (% of respondents who indicated a deterioration)</p> <p>6.3 Willingness of banks to provide a loan (% of respondents who indicated a deterioration)</p> <p>6.4 Relative difference in interest rate levels between loans up to EUR 1 million and loans over EUR 1 million</p> <p>6.5 Total duration to get paid (no. of days)</p> <p>6.6 Lost payments (% of total turnover)</p> <p>6.7 Venture capital investments - early stage (% of GDP)</p> <p>6.8 Strength of legal rights</p> <p>6.9 Depth of credit information index</p>
<p><b>II. Second chance</b></p> <p>2.1 Time to close a business (in years)</p> <p>2.2 Cost to close a business (cost to recover debt as % of debtor's estate)</p> <p>2.3 Degree of support for a second chance (%)</p>	<p><b>VII. Single market</b></p> <p>7.1 SMEs with intra-EU imports (%)</p> <p>7.2 SMEs with intra-EU exports (%)</p> <p>7.3 Single market directives not transposed or notified(%)</p> <p>7.4 Number of directives overdue by 2+ years</p> <p>7.5 Average transposition delay- overdue directives (months)</p>
<p><b>III. Think small first</b></p> <p>3.1 Communication and simplification of rules and procedures (0=best, 6=worst)</p> <p>3.2 Burden of government regulations (1=worst, 7=best)</p> <p>3.3 Licenses and permits systems (0=best, 6=worst)</p>	<p><b>VIII. Skills and innovation</b></p> <p>8.1 SMEs introducing product or process innovations (%)</p> <p>8.2 SMEs introducing marketing or organizational innovations (%)</p> <p>8.3 SMEs innovating in-house (%)</p> <p>8.4 Innovative SMEs collaborating with others (%)</p> <p>8.5 Sales of new-to-market and new-to-firm innovations (% turnover)</p> <p>8.6 SMEs participating in EU funded research (number per 100.000 SMEs)</p> <p>8.7 SMEs selling online (% of SMEs)</p> <p>8.8 SMEs purchasing online (% of SMEs)</p> <p>8.9 Enterprises providing training to their employees (%)</p> <p>8.10 Employees' participation rate in education and training (% of total no. of employees in micro firms)</p>
<p><b>IV. Responsive Administration</b></p> <p>4.1 Time to start a business (in calendar days)</p> <p>4.2 Cost to start a business (% of income per capita)</p> <p>4.3 Paid in minimum capital (% of income per capita)</p> <p>4.4 Time required to transfer property (in calendar days)</p> <p>4.5 Cost required to transfer property (% of prop. value)</p> <p>4.6 Number of tax payments per year</p> <p>4.7 Time required to comply with major taxes (hours/y)</p> <p>4.8 Cost to enforce contracts (% of claim)</p> <p>4.9 Full online availability of the basic public services to businesses</p>	<p><b>IX. Environment</b></p> <p>9.1 Innovations with environmental benefits</p> <p>9.2 SMEs that have introduced resource-efficiency measures (%)</p> <p>9.3 SMEs that have benefitted from public support measures for resource-efficiency actions (%)</p> <p>9.4 SMEs that offer green products or services (%)</p> <p>9.5 SMEs with more than 50% turnover generated by green products or services (%)</p> <p>9.6 SMEs that have benefitted from public support measures for production of green products (%)</p>
<p><b>V. State aid and Public procurement</b></p> <p>5.1 SME's share in total value of public contracts awarded (%)</p> <p>5.2 State aid for SMEs (% of total aid for SMEs)</p> <p>5.3 Average delay in payments from public authorities (days)</p> <p>5.4 e-Procurement availability (pre-award)</p> <p>5.5 EU Regional Funds for entrepreneurship and SMEs in 2007-2013 (% of total allocation by Member State)</p> <p>5.6 EU funds for business creation and development in 2007-2013 (% of EAFRD total allocation)</p>	<p><b>X. Internationalization</b></p> <p>10.1 SMEs importing from outside the EU (% of SMEs)</p> <p>10.2 SMEs exporting outside the EU (% of SMEs)</p> <p>10.3 Cost required to import (in USD)</p> <p>10.4 Time required to import (in days)</p> <p>10.5 Number of documents required to import</p> <p>10.6 Cost required to export (in USD)</p> <p>10.7 Time required to export (in days)</p> <p>10.8 Number of documents required to export</p>

The fifth principle on **State aid and Public procurement** draws on six indicators, which measure the SME's share in the total value of public contracts awarded, state aid for SMEs, delay in payments from public authorities, e-procurement availability, amount of EU Regional Funds for entrepreneurship and SMEs in 2007-2013, and finally amount of EU EAFRD funds for business creation and development in 2007-2013.

The sixth principle on **Access to Finance** is built of nine indicators that measure rejected loan applications/offers, access to public financial support including guarantees, willingness of banks to provide a loan, relative difference in interest rate levels between loans up to and over EUR 1 million, total duration to get paid, lost payments, early stage of venture capital investments, strength of legal rights, and finally depth of credit information index.

The seventh principle on **Single Market** is captured by five indicators, measuring SMEs with intra-EU imports/exports, single market directives not transposed or notified, number of directives overdue by 2+ years, and finally transposition delay for overdue directives.

The eighth principle on **Skills and Innovation** is a mix of ten indicators that evaluate SMEs introducing product or process innovations, SMEs introducing marketing or organizational innovations, SMEs innovating in-house, innovative SMEs collaborating with others, sales of new-to-market and new-to-firm innovations, SMEs participating in EU funded research, SMEs selling/purchasing online, enterprises providing training to their employees, and finally employees participating in education and training.

The ninth principle on **Environment** builds on six indicators, namely innovations with environmental benefits, SMEs that have introduced resource-efficiency measures, SMEs that have benefitted from public support measures for resource-efficiency actions, SMEs that offer green products or services, SMEs with more than 50% turnover generated by green products or services, and finally SMEs that have benefitted from public support measures for production of green products.

The tenth principle on **Internationalization** describes the SMEs landscape along eight indicators measuring importing/exporting from outside the EU, and the cost/time/documents required to import/export.

The SBA profiles are refined every year in a transparent exercise to improve the way SMEs performance is measured. This year, it has been possible to include the principle on

Environment (not done last year due to lack of sufficient data). Second, the two indicators measuring (a) EU Regional Funds for entrepreneurship and SMEs and (b) EAFRD funds for business creation and development in 2007-2013, which were included in the 2011 release under Access to Finance, they were now moved to State aid and procurement for conceptual reasons: they fit more in the rationale of adapting public policy tools to SME needs than in the rationale of facilitating SMEs' access to finance and developing a legal and business environment supportive to timely payments in commercial transactions. This conceptual refinement to the framework is justified also statistically given that the two indicators are more correlated to the principle on State aid than on Access to finance (see Section 4 for more details).

The SBA principles are calculated for each year from 2007-2012 for the 27 EU Member States and the ten non-EU countries. However, when discussing the current situation in the SBA factsheets, the timeliest indicators are used. About 50% of the dataset is from 2011-2012, 20% from 2009-2010, 10% from 2008, and merely 2% from earlier years (2004-2007). The remaining 17% of the dataset are missing values, which were estimated by the JRC using time-series-cross-sectional imputation (see Section 3 for more details). Hence, the SBA profiles have good coverage of the years where the economic crisis attained its initial peak, when SMEs were most severely affected, and when stimulus programs were decided and meant to be put into action. That said, the time coverage does not allow us to capture more medium-term effects of the crisis or the stimulus programs on SMEs, some impacts of which might be very long-term (e.g., EU Regional Funds for entrepreneurship and SMEs). Moreover, the renewed setback of the European economy in the second half of 2011 and the current set-backs to the world economy, as well as possible new spending measures are not accounted for. These effects will naturally be at the heart of future SBA profiles.

### 3. SBA Fact Sheets - Methodology

The SBA principles intend to picture the landscape of SMEs performance in Europe by focusing on ten dimensions, as reported in the related Commission Communication document (COM(2008) 394 final). This section reviews the methodological choices made by the JRC together with DG ENTR in order to combine the underlying indicators described in the previous section into the SBA principles. The calculation of the SBA principles can be outlined in five key steps:

*Step 1.* Raw data for the selected indicators are first checked for reporting errors and outliers that could strongly bias the results are treated.

*Step 2.* Missing data are estimated using a time-series cross-sectional algorithm.

*Step 3.* Indicators are normalized by the min-max method, taking the direction of their effect into account.

*Step 4.* Equal weights are assigned to the indicators (highly correlated indicators are counted as a single indicator).

*Step 5.* The SBA principles are calculated as simple arithmetic average of the normalized indicators per country for 2007-2012.

Next, we describe in more detail each of those steps.

#### *Step 1: Selection of indicators and data checks*

Candidate indicators were selected by DG ENTR for their relevance to a specific SBA principle (based on literature review and consultation with national experts) 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.

The most complete time series data were considered for each country, with a cut-off at year 2004. Country scores for a given principle were calculated only if data availability was at least 60% in that principle. Data values outside the 1.5 interquartile range were checked for reporting

errors.<sup>5</sup> 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<sup>6</sup>. They were treated by winsorisation, where the few (up to three) 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.<sup>7</sup>

### *Step 2: Missing data*

In past releases of the SBA factsheets, for reasons of transparency and replicability, missing data were not estimated; instead principle scores were calculated using only available information for each country. Despite this approach being common in relevant contexts and being a good starting point, it has notable shortcomings, as it may might discourage countries from reporting low data values.<sup>8</sup> For the 2012 release<sup>9</sup>, a more suitable imputation approach that combines multiple imputation with trend analysis was carried out by the JRC. The missing data were imputed using a bootstrap time-series cross-sectional expectation-maximization algorithm implemented in the software package Amelia II<sup>10</sup>. This approach has comparative advantages over other imputation methods<sup>11</sup>, and has proven to work efficiently with various datasets and with different degrees of missingness. For our purposes, ten complete datasets were imputed with observed values remaining the same but missing values were filled in with a distribution of imputations that reflect the uncertainty about the missing data<sup>12</sup>. For each missing data point in the country-year matrices, the average of the ten imputed values was taken as the best estimate.

---

<sup>5</sup> The interquartile range is the difference between the upper (75% of values) and the lower (25% of values) quartiles.

<sup>6</sup> 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.

<sup>7</sup> For the most recent year dataset, the nine indicators that were winsorized because very high values (three values in the worst case) were distorting the distribution were: cost to start a business, number of tax payments per year in Responsive administration; average delay in payments from public authorities, EU regional funds for entrepreneurship in State aid and public procurement; venture capital investments in Access to finance; SMEs with intra-EU imports, SMEs with intra-EU exports, number of directives overdue by 2+ years in Single Market; SMEs importing from outside the EU in Internationalization.

<sup>8</sup> Note that here ‘no imputation’ is equivalent to replacing missing values with the average of the available data within each principle.

<sup>9</sup> As well as for the 2011 release of the SBA profiles

<sup>10</sup> J. Honaker and G. King, 2010; J. Honaker, G. King, and M. Blackwell, 2012; G. King et al., 2001.

<sup>11</sup> M. Blankers, M. W. J. Koeter, and G. M. Schippers, 2010

<sup>12</sup> J. Honaker, G. King, and M. Blackwell, 2012:3

### *Step 3: Normalisation*

Given that the indicators used to measure achievement in each principle are expressed in different units (years and dollars per capita), a normalization to a common scale is required. The methods that are most frequently used are standardization (or z-scores) and re-scaling.

$$\text{Standardization: } \frac{x_i - \text{mean}(x)}{\text{std}(x)}$$

This method converts the indicators to a common scale of mean zero and standard deviation of one. Therefore it rewards exceptional behavior, i.e. above-average performance of a given indicator yields higher scores than consistent average scores across all indicators.

$$\text{Re-scaling: } \frac{x_i - \min(x)}{\max(x) - \min(x)}$$

This approach is easier to communicate to a wider public, given that it normalizes indicators to an identical range [0, 1], where higher scores represent better achievement. A key advantage of this method over standardization, at least in the context of the SBA framework, is that re-scaling widens the range of an indicator, which is an advantage for those indicators with a small range of values. This is useful for the SBA profiles to allow differentiation between countries with similar levels of SMEs performance. However, this method is not appropriate in the presence of extreme values or outliers, which can distort the normalized indicator. To control for this, in step 1 above we identified and treated extreme values. The minimum and maximum values needed for the re-scaling were determined in the “complete”<sup>13</sup> dataset in the 2007-2012 period.

The direction of the indicators’ effect was taken into account at this stage. For indicators where higher raw values are desirable, such as SMEs with intra-EU exports, the formula was  $\frac{x_i - \min(x)}{\max(x) - \min(x)}$ . For indicators where lower raw values are desirable, such as time to start a business, the formula was:  $\frac{\max(x) - x_i}{\max(x) - \min(x)}$

### *Step 4: Weights*

The SBA profiles, for simplicity and upon suggestion of the country desks, are calculated using equal weights for the indicators underlying each principle. There are a few exceptions that

---

<sup>13</sup> after the imputation

involve highly correlated<sup>14</sup> indicators, which were treated by the JRC as a single indicator (by assigning half weight to each normalized score). We anticipate here that assigning equal weights to the indicators does not necessarily guarantee an equal contribution of the indicators to the variance of the country scores on the SBA principles. We will discuss this point thoroughly in Section 4.

#### *Step 5: Aggregation*

The most popular methods of aggregation in the relevant literature are the arithmetic and geometric means. The arithmetic mean has been traditionally used to compute most of the well-known indices in the international scene. Some counter arguments for the use of the arithmetic mean are: (a) perfect substitutability, i.e. poor performance in one indicator can be fully compensated by good performance in another, (b) no reward for balance: the arithmetic mean does not penalize the differences in values between indicators, i.e. it does not reward balanced achievement in all indicators, (c) no impact of poor performance: the arithmetic mean does not consider that the lower the performance in a particular indicator, the more urgent it becomes to improve achievements in that indicator.

All these counter arguments for the use of the arithmetic mean would have been valid if the ten SBA principles would have been aggregated into a single number. In that case, full compensability of the ten dimensions would not have been desirable. Yet, within each principle, compensation among the indicators is desirable.

With this conceptual justification, the SBA principles are calculated using a simple mean of the normalised indicators per country for each year from 2007 to 2012. Country scores for each principle are also calculated using the most recent data. To allow for better comparison among countries performance, the data for the most recent year are re-scaled in the 0-1 scale.

Progress rates per country and principle are also calculated over 2007-2012. The formula for the compound annual growth rate is:  $\left(\frac{y_{2012}}{y_{2007}}\right)^{1/5} - 1$ , where y refers to the country score on a given principle. For those countries and principles where data coverage over 2007-2012 is relatively poor, progress rates are not reported in the SBA factsheets.

---

<sup>14</sup> Highly correlated indicators (i.e., Pearson correlation coefficients greater than  $\sim 0.90$  over 2007-2012) were treated as a single indicator. These were: the pair of SMEs selling online and SMEs purchasing online, the triplet of SMEs introducing product or process innovations, SMEs introducing marketing or organizational innovations, SMEs innovating in-house (within Skills and innovation), the pair of time required to export, time required to import (within Internationalization).

## 4. Conceptual and statistical coherence

This section delves into the conceptual and statistical coherence in the SBA framework.

### *Principal component analysis and cross-correlation analysis*

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. Table 3 shows the amount of indicators' variance explained by the first principal component (else termed latent dimension) and by the SBA principle<sup>15</sup>. The first latent dimension in each principle captures between 25% and 53% of the total variance in the underlying indicators. More variance is explained in the more homogenous principles – Second chance, Skills and innovation and Environment– whilst less variance is captured by the more heterogeneous principles –Responsive administration and Access to finance. For simplicity and ease of communication, the SBA principles are calculated as simple means of the underlying indicators. This choice receives statistical justification, at least in terms of the total variance explained, given that amount of variance explained by the SBA principle is for eight of the ten principles, very similar to the maximum variance that could be explained by a linear function. For two principles – Think small first, State aid and public Procurement – the amount of variance explained by the simple average of the underlying indicators is less than what would have been explained by the first latent dimension. In any case, the multidimensionality of the ten principles discussed here, suggests that it is important to give more emphasis on the individual indicators of the SBA principles, as the scores on the ten SBA principles can be considered as only indicative of the amount of information contained in the underlying indicators. In fact, DG ENTRR discusses the countries scores on the SBA principles but the bulk of information and discussion in the SBA factsheets relates to the individual indicators that populate the SBA framework.

---

<sup>15</sup> The first principal component is a weighted average of the indicators, whereby the indicators receive statistically driven weights based on the covariance matrix. An important property of the first principal component is that it captures the maximum possible variance in the underlying indicators that could be explained by any weighted arithmetic average of the underlying indicators.

**Table 3. Variance explained the SBA principles and the principal components**

SBA principle	Variance explained by the first principle component	Variance explained by the SBA principle
I. Entrepreneurship	30%	25%
II. Second Chance	53%	52%
III. Think Small First	45%	29%
IV. Responsive Administration	25%	22%
V. State aid and Public procurement	34%	13%
VI. Access to Finance	29%	26%
VII. Single Market	49%	49%
VIII. Skills and Innovation	52%	50%
IX Environment	51%	50%
X. Internationalization	41%	40%

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 4). These results have 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.

**Table 4. Example of coherence test in the Internationalization principle**

	I	II	III	IV	V	VI	VII	VIII	IX	X
SMEs importing from outside the EU	0.17	-0.04	0.13	-0.01	0.34	0.35	<b>0.50</b>	0.07	-0.33	0.50
SMEs exporting outside the EU	0.02	0.17	0.40	0.29	0.29	0.45	0.42	0.43	0.14	0.56
Cost required to import	0.26	0.09	0.36	0.07	0.21	0.37	0.22	0.25	0.07	0.78
Time required to export/import	0.03	0.60	0.51	0.57	0.31	0.38	0.06	<b>0.64</b>	0.41	0.65
Number of documents required to export	-0.03	0.44	0.46	0.45	0.37	0.29	-0.14	<b>0.63</b>	0.49	0.55
Cost required to export	0.30	0.15	0.34	0.08	0.18	0.35	0.18	0.23	0.06	0.77
Number of documents required to import	0.03	0.52	0.41	0.48	0.37	0.35	-0.15	<b>0.60</b>	0.40	0.58

Notes: (1) Pearson correlation coefficients between the indicators included in the Internationalization principle and the ten SBA principles. (2) I. Entrepreneurship, II. Second Chance, III. Think Small First, IV. Responsive Administration, V. State aid and Public procurement, VI. Access to Finance, VII. Single Market, VIII. Skills and Innovation, IX Environment, X. Internationalization. (3) The numbers in grey are the correlation coefficients of the indicators with their own SBA principle, and the numbers in bold were considered high enough to be taken into consideration when interpreting the results.

### *Assessment of the implicit weights*

Another test of statistical coherence relates to the assessment of the implicit weights. Despite the equal weights assigned to the indicators (highly correlated indicators are counted as one), the implicit weights of the indicators are not necessarily equal. The implicit weights are a function of the nominal weights, the data correlation structure and the indicators' variances. We calculate the implicit weights using a non-linear measure, the kernel estimate of the Pearson correlation ratio<sup>16</sup>. If indicators are supposed to be equally important their implicit weights should not differ too much. Results are overall reassuring: in most SBA principles the underlying indicators have similar implicit weights in classifying countries within each dimension, though some indicators are slightly more important than others (see Table 5). In few cases, though, as for the Entrepreneurship, not all indicators have the same implicit weight. Should one aim for an equal contribution of the indicators to the overall variance of the Entrepreneurship scores, then the weight assigned to the opportunity-driven entrepreneurship, entrepreneurial intention and self-employment rate should be greater than one-ninth (as it is the case now). This remark would be highly relevant if one attempted to produce a ranking of the countries based on the SBA principles scores. In the context of the SBA factsheets, where the emphasis is given on the underlying indicators and the SBA scores are used as a mere indication of a country's performance with respect to the EU average, this analysis is meant to shed more light and transparency on the number crunching in the calculation of the SBA principles.

---

<sup>16</sup> Paruolo et al., 2013, discuss four properties of the Pearson correlation ratio (else termed first order sensitivity measure), which render the correlation ratio a suitable measure of the indicators' implicit weights: (a) it offers a precise definition of importance, that is 'the expected reduction in variance of an index that would be obtained if a variable could be fixed'; (b) it can be used regardless of the degree of correlation between variables; (c) it is model-free, in that it can be applied also in non-linear aggregations; (d) it is not invasive, in that no changes are made to the index or to the correlation structure of the indicators.

**Table 5. Implicit weights of the indicators in the ten SBA principles**

	I	II	III	IV	V	VI	VII	VIII	IX	X
#.1	0.04* [0.04, 0.15]	0.62 [0.62, 0.68]	0.42 [0.42, 0.48]	0.34 [0.22, 0.34]	0.15 [0.12, 0.24]	0.43 [0.43, 0.51]	0.62 [0.54, 0.65]	0.53 [0.52, 0.59]	0.74 [0.74, 0.79]	0.25 [0.25, 0.36]
#.2	0.44 [0.42, 0.52]	0.59 [0.59, 0.63]	0.34 [0.32, 0.43]	0.28 [0.23, 0.32]	0.13 [0.1, 0.22]	0.29 [0.14, 0.3]	0.53 [0.5, 0.58]	0.04* [0.03, 0.13]	0.64 [0.64, 0.69]	0.31 [0.3, 0.39]
#.3	0.1* [0.1, 0.18]	0.34* [0.34, 0.43]	0.09* [0.09, 0.18]	0.14* [0.07, 0.22]	0.02* [0.02, 0.16]	0.07* [0, 0.09]	0.39 [0.39, 0.49]	0.51 [0.42, 0.52]	0.8 [0.73, 0.81]	0.62 [0.61, 0.67]
#.4	0* [0, 0.1]			0.25 [0.24, 0.38]	0.39 [0.38, 0.49]	0.45 [0.42, 0.48]	0.5 [0.5, 0.56]	0.63 [0.62, 0.69]	0.57 [0.55, 0.61]	0.41 [0.34, 0.43]
#.5	0.27 [0.23, 0.35]			0.01* [0, 0.1]	0.05* [0.04, 0.15]	0.02* [0.02, 0.09]	0.47 [0.47, 0.55]	0.65 [0.63, 0.68]	0.1* [0.1, 0.21]	0.61 [0.58, 0.68]
#.6	0.5 [0.49, 0.56]			0.33 [0.29, 0.42]	0.14 [0.12, 0.24]	0.34 [0.33, 0.44]	0.62 [0.54, 0.65]	0.53 [0.5, 0.57]	0.42 [0.27, 0.46]	0.56 [0.41, 0.56]
#.7	0.23 [0.23, 0.36]			0.47 [0.46, 0.56]	0.15 [0.12, 0.24]	0.32 [0.29, 0.37]	0.53 [0.5, 0.58]	0.71 [0.64, 0.76]		0.37 [0.31, 0.41]
#.8	0.25 [0.2, 0.32]			0.42 [0.13, 0.44]		0.48 [0.39, 0.49]	0.39 [0.39, 0.49]			
#.9	0.52 [0.52, 0.59]			0.32 [0.32, 0.43]		0.3 [0.22, 0.39]	0.5 [0.5, 0.56]			
#.10	0.04* [0.04, 0.15]					]	0.47 [0.47, 0.55]			

Notes: (1) Numbers represent the kernel estimates of the Pearson correlation ratio ( $\eta^2$ ) and were calculated based on the approach suggested in Paruolo *et al.*, 2013. Min-max estimates for the  $\eta^2$  derive from the choice of the smoothing parameter. (2) The order of the indicators is the same as in Table 2 (highly correlated indicators have been combined to one). (3) Indicators that have much lower contribution to the variance of the relevant SBA principle than the equal weighting expectation are marked with an asterisk. (4) I. Entrepreneurship, II. Second Chance, III. Think Small First, IV. Responsive Administration, V. State aid and Public procurement, VI. Access to Finance, VII. Single Market, VIII. Skills and Innovation, IX Environment, X. Internationalization.

*Ten SBA principles: one number?*

The statistical properties of a single country score out of the ten principles were explored. From a statistical point, it is not recommended to combine the ten principles together by calculating an average (be that arithmetic, geometric or other) for the following reason. There are three latent dimensions in the ten SBA principles that altogether capture 68% of the total variance (see Table 6). The first latent dimension describes only 37% of the total variance. Hence, any index out of the ten SBA principles would only capture slightly over one-third of the total variance in the ten principles. Instead, it may be helpful to look at the “statistical” grouping of these ten principles. The first latent dimension is described by five principles: Second chance, Think small first, Responsive administration, Skills and innovation and Environment (32% explained variance), the second latent dimension is described by four principles: State aid and public procurement, Access to finance, Single market, and Internationalization (24% explained variance), and the third latent dimension is entirely described by Entrepreneurship (12% explained variance). There might be an added value in analyzing these three latent dimensions of the ten SBA principles, that would then be presented separately, e.g. with countries displayed on simple bi-dimensional radar plots, provided that a meaningful interpretation of these latent dimensions can be made by the relevant experts on the field.

**Table 6. Principal Components Analysis results for the SBA principles**

	Principal Component 1	Principal Component 2	Principal Component 3
I. Entrepreneurship	0.00	0.06	0.95
II. Second chance	0.75	0.02	0.22
III. Think small first	0.59	0.46	-0.07
IV. Responsive administration	0.79	0.16	0.07
V. State aid and public procurement	-0.02	0.76	-0.04
VI. Access to finance	0.26	0.68	0.21
VII. Single market	-0.24	0.58	-0.37
VIII. Skills and innovation	0.77	0.40	0.02
IX. Environment	0.85	-0.22	-0.10
X. Internationalization	0.46	0.73	0.17
Explained variance (% total)	32%	24%	12%

Notes: (1) The pooled dataset of 37 countries in 2007-2012 was used. The numbers in light blue reflect the highest component loading of an SBA principle (three components were extracted and rotated with the varimax method).

After these conceptual and statistical considerations, the results were evaluated by DG ENTR together with the Members of the EU Working Group on SMEs and Entrepreneurship to verify that the country scores on the SBA principles and the progress rates over 2007-2012 are, to a great extent, consistent with current evidence on policy measures deemed relevant by local SME

policy experts (contracted by Ecorys, DG ENTR's lead contractor for the SBA factsheets). This is how the 2012 SBA factsheets were then produced as 16-page summary per country.

## **5. Impact of modeling assumptions on the SBA results**

Every country score on an SBA principle is the outcome of a number of choices: the indicators selected, the estimation 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 normalize the indicators), driven by statistical analysis (e.g., averaging pairs of highly correlated indicators prior to the final aggregation step) or simplicity (e.g., arithmetic mean of the indicators). This section will assess the uncertainty of the SBA principles attributed to those judgments which cannot be fully justified neither by theoretical reasons, nor by the data properties, namely, the estimation of missing data, the min-max normalization of the indicators, the equal weights attached to the indicators and the aggregation formula (simple mean). 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 and eventual errors and typos were corrected during this phase (see Step 2 in Section 3).

An important remark before discussing methods and results is that the uncertainty analysis cannot inform on the quality of the framework underpinning the SBA principles. This was the aim of the analysis carried out in Section 4. Instead, the results in this section can only provide information on the validity of inferences associated with the country scores on the SBA principles. Given the multidimensionality of the SBA principles (any aggregate measure of the underlying indicators could only capture 25-53% of the total variance), it is taken for granted that if country rankings on the SBA principles were to be presented, these rankings would have been very sensitive to the methodological choices<sup>17</sup>. However, DG ENTR produces the SBA factsheets discussing only a country's performance with respect to the EU average and is cautious about not producing any ranking. For this reason, the uncertainty analysis will aim to

---

<sup>17</sup> Robustness is to some extent the flip side of redundancy: a very high correlation between indicators will lead to an index ranking is practically not affected by the methodological choices, so the index will be both robust and redundant. Similarly, a low correlation among indicators implies that the methodological choices are very important in determining country rankings, and thus that the index is unlikely to be robust to these choices.

check whether the SBA principles provide a biased picture of the countries' performance with respect to the EU average.

**Table 7. Uncertainty parameters (missing values, normalization, weights, aggregation)**

Type of uncertainty	Reference	Alternative
A. Uncertainty in the treatment of missing data	St. error estimates by the bootstrap time-series cross-sectional expectation-maximization algorithm implemented in the software package Amelia II	
B. Uncertainty in the normalization method	Min-max	z-scores
C. Uncertainty in the aggregation function	arithmetic average	geometric average
D. Uncertainty intervals for the weights	Reference value for the weight	Distribution assigned for uncertainty analysis ( $\pm 25\%$ reference value)
I. Entrepreneurship (# 9)	0.111	U[0.083 ,0.139]
II. Second chance (# 3)	0.333	U[0.25 ,0.417]
III. Think Small first (#3)	0.333	U[0.25 ,0.417]
IV. Responsive administration (#9)	0.111	U[0.083 ,0.139]
V. State aid and public procurement (#6)	0.167	U[0.125 ,0.208]
VI. Access to finance (#9)	0.111	U[0.083 ,0.139]
VII. Single market (# 5)	0.200	U[0.15 ,0.25]
VIII. Skills and innovation (#7)	0.143	U[0.107 ,0.179]
IX. Environment (#6)	0.167	U[0.125 ,0.208]
X. Internationalization (#7)	0.143	U[0.107 ,0.179]

Notes: (1) The number of indicators within a principle is given in the parenthesis. Highly correlated indicators are counted as one.

The uncertainty analysis of the 2012 SBA principles was based on a combination of a Monte Carlo experiment and a multi-modelling approach (see Table 7). This type of assessment aims to respond to eventual criticism that the country scores associated with indices are frequently presented as if they were calculated under conditions of certainty, while this is, by definition of the index, not the case.<sup>18</sup> The Monte Carlo simulation (10,000 runs) related to the issue of missing data estimation and weighting of the indicators. Estimates for missing data were sampled from their probability distribution estimated by the time-series cross-sectional algorithm. Different set of weights of the indicators were randomly sampled from uniform 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

<sup>18</sup> Saisana et al., 2005; Saisana et al., 2011.

respect the rationale of the SBA principles that no indicator dominates an SBA principle. Given these considerations, limit values of uncertainty intervals have been defined as shown in Table 7.

The multi-modelling approach involved combinations of the remaining two key assumptions on the normalisation method and the aggregation formula. Although there are arguments in favour of the min-max method for normalizing the indicators versus the z-scores approach (see Section 3), one may still argue that since countries achievements on a given SBA principle are seen vis-a-vis the EU average, z-scores could have been used. An additional argument in favour of the z-scores approach is that all normalized indicators have the same variance, and thereafter the implicit weights are only a function of the correlation structure between the indicators (assuming equal nominal weights as it is the case here). Finally, regarding the assumption on the aggregation function (arithmetic average) decision-theory practitioners have challenged this type of aggregation because of the fully compensatory nature, in which a comparative high advantage of a few variables can compensate a comparative disadvantage of many variables (see also comments in Section 3).<sup>19</sup> Hence, we considered the geometric average instead,<sup>20</sup> which is a partially compensatory approach. Consequently, we tested 4 models based on the combination of the min-max versus z-scores normalisation, or arithmetic versus geometric average. Combined with the 10,000 simulations to account for the uncertainty in the estimates for the missing data and the weights for the indicators, we carried out altogether 40,000 simulations for each SBA principle.

The uncertainty analysis results are shown in Table 8 to Table 20<sup>21</sup>. In the following we give an example for Austria of how these results should be interpreted.

On the 2012 SBA factsheets, Austria is classified on Entrepreneurship as having an above EU performance, yet this is confirmed in 50% of the simulated cases. In the remaining 50% of the simulations, Austria's performance is close to the EU average. This can be explained, and expected, given the profile of Austria in the nine indicators underlying the Entrepreneurship principle, whereby four indicators are above the EU average, two indicators close to the EU

---

<sup>19</sup> Munda, 2008.

<sup>20</sup> In the geometric average, indicators are multiplied as opposed to summed in the arithmetic average. Indicator weights appear as exponents in the multiplication. To avoid close to zero values biasing the geometric average, we re-scaled linearly the indicators scores to a minimum of 0.1.

<sup>21</sup> In case of insufficient data coverage, some SBA principles have not been calculated for some countries (example, see Table 20 for Turkey, where no scores are calculated on State aid and public procurement or on Single market). For those cases, the simulations should be considered as being entirely dependent on the estimates of missing data and not on reported values.

average, and three indicators below the EU average<sup>22</sup>. Undoubtedly though, Austria is above the EU average on three principles – Think small first, Skills and Innovation, and Environment. On the opposite side, Austria’s performance below the EU average on Responsive administration is not a mere symptom of the methodological choices made during the calculation of the principle, but a result that depends entirely on the selected indicators (99% of the simulations place Austria below the EU average on Responsive Administration).

Overall, country classifications with respect to the EU average in the 2012 SBA factsheets are supported by the simulations and these classifications are robust for 75% of the cases<sup>23</sup> to the methodological choices related to the estimation of missing data, normalization, weighting or aggregation method.

The uncertainty analysis presented herein can disentangle a country’s performance from the methodological judgments made in the development of the SBA principles and reliably provide information on a country’s strengths or weaknesses compared to the EU average. Thus, this type of analysis is critically helpful for policy makers and experts to understand existing successes and areas of improvement in each country. Needless to emphasize again that this should be done in conjunction with the detailed information on the indicators within each principle, as this is provided in the specific country factsheets of DG ENTR.

---

<sup>22</sup> See the 2012 SBA country factsheets at: [http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/performance-review/index\\_en.htm](http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/performance-review/index_en.htm)

<sup>23</sup> Over a total of 370 cases (37 countries x 10 principles) for the most recent year

**Table 8. SBA principles: Simulations for Austria, Belgium, Bulgaria**

Probabilistic assessment			
<b>Austria</b> SBA	Below EU	Close to EU	Above EU
Entrepreneurship	17%	83%	0%
Second chance	58%	42%	0%
Think small first	0%	0%	100%
Responsive administration	99%	1%	0%
State aid and public procurement	34%	24%	42%
Access to finance	0%	50%	50%
Single market	67%	33%	0%
Skills and innovation	0%	0%	100%
Environment	0%	5%	95%
Internationalization	0%	61%	39%
Probabilistic assessment			
<b>Belgium</b> SBA	Below EU	Close to EU	Above EU
Entrepreneurship	100%	0%	0%
Second chance	0%	59%	41%
Think small first	100%	0%	0%
Responsive administration	61%	40%	0%
State aid and public procurement	0%	65%	35%
Access to finance	0%	50%	50%
Single market	0%	98%	2%
Skills and innovation	0%	17%	83%
Environment	0%	100%	0%
Internationalization	55%	45%	0%
Probabilistic assessment			
<b>Bulgaria</b> SBA	Below EU	Close to EU	Above EU
Entrepreneurship	100%	0%	0%
Second chance	100%	0%	0%
Think small first	1%	99%	0%
Responsive administration	18%	82%	0%
State aid and public procurement	0%	51%	49%
Access to finance	0%	50%	50%
Single market	50%	50%	0%
Skills and innovation	100%	0%	0%
Environment	100%	0%	0%
Internationalization	100%	0%	0%

**Table 9. SBA principles: Simulations for Cyprus, Czech Republic, Denmark**

Probabilistic assessment			
Cyprus SBA	Below EU	Close to EU	Above EU
Entrepreneurship ▲	0%	6%	94%
Second chance ▬	0%	100%	0%
Think small first	0%	100%	0%
Responsive administration ▼	46%	54%	0%
State aid and public procurement ▬	50%	50%	0%
Access to finance ▬	54%	47%	0%
Single market ▬	47%	53%	0%
Skills and innovation ▬	0%	82%	18%
Environment ▼	100%	0%	0%
Internationalization ▲	0%	59%	41%
Probabilistic assessment			
Czech Republic SBA	Below EU	Close to EU	Above EU
Entrepreneurship ▼	99%	1%	0%
Second chance ▼	100%	0%	0%
Think small first ▼	100%	0%	0%
Responsive administration ▼	100%	0%	0%
State aid and public procurement ▬	55%	45%	0%
Access to finance ▬	50%	50%	0%
Single market ▼	100%	0%	0%
Skills and innovation ▬	0%	99%	1%
Environment ▬	19%	81%	0%
Internationalization ▼	100%	0%	0%
Probabilistic assessment			
Denmark SBA	Below EU	Close to EU	Above EU
Entrepreneurship ▼	100%	0%	0%
Second chance ▲	0%	34%	66%
Think small first ▲	0%	0%	100%
Responsive administration ▲	0%	50%	50%
State aid and public procurement ▲	50%	0%	50%
Access to finance ▬	50%	33%	17%
Single market ▲	0%	45%	55%
Skills and innovation ▲	0%	0%	100%
Environment ▬	0%	100%	0%
Internationalization ▲	0%	0%	100%

**Table 10. SBA principles: Simulations for Estonia, Finland, France**

Probabilistic assessment				
<b>Estonia</b>	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	▼	100%	0%	0%
Second chance	▼	100%	0%	0%
Think small first	▲	0%	0%	100%
Responsive administration	▲	0%	50%	50%
State aid and public procurement	▲	0%	18%	82%
Access to finance	▬	0%	88%	12%
Single market	▲	0%	0%	100%
Skills and innovation	▲	0%	64%	36%
Environment	▼	100%	0%	0%
Internationalization	▲	0%	0%	100%
Probabilistic assessment				
<b>Finland</b>	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	▲	0%	17%	84%
Second chance	▲	0%	0%	100%
Think small first	▲	0%	0%	100%
Responsive administration	▲	0%	41%	59%
State aid and public procurement	▲	0%	50%	50%
Access to finance	▲	0%	0%	100%
Single market	▬	0%	100%	0%
Skills and innovation	▲	0%	0%	100%
Environment	▲	0%	0%	100%
Internationalization	▲	0%	0%	100%
Probabilistic assessment				
<b>France</b>	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	▬	0%	100%	0%
Second chance	▬	0%	94%	6%
Think small first	▬	31%	69%	0%
Responsive administration	▲	0%	50%	50%
State aid and public procurement	▬	0%	81%	19%
Access to finance	▬	0%	100%	0%
Single market	▼	94%	6%	0%
Skills and innovation	▬	0%	100%	0%
Environment	▬	43%	57%	0%
Internationalization	▲	0%	51%	49%

**Table 11. SBA principles: Simulations for Germany, Greece, Hungary**

Probabilistic assessment				
<b>Germany</b>	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	▼	84%	16%	0%
Second chance	▲	0%	46%	54%
Think small first	▼	94%	6%	0%
Responsive administration	▲	0%	50%	50%
State aid and public procurement	▬	0%	98%	2%
Access to finance	▲	0%	50%	50%
Single market	▬	0%	100%	0%
Skills and innovation	▲	0%	0%	100%
Environment	▲	0%	0%	100%
Internationalization	▬	0%	100%	0%
Probabilistic assessment				
<b>Greece</b>	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	▬	0%	95%	5%
Second chance	▲	0%	66%	35%
Think small first	▼	100%	0%	0%
Responsive administration	▼	100%	0%	0%
State aid and public procurement	▼	100%	0%	0%
Access to finance	▼	100%	0%	0%
Single market	▬	0%	100%	0%
Skills and innovation	▬	53%	47%	0%
Environment	▬	0%	78%	22%
Internationalization	▼	100%	0%	0%
Probabilistic assessment				
<b>Hungary</b>	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	▼	100%	0%	0%
Second chance	▼	100%	0%	0%
Think small first	▼	100%	0%	0%
Responsive administration	▬	2%	98%	0%
State aid and public procurement	▼	100%	0%	0%
Access to finance	▼	100%	0%	0%
Single market	▬	50%	50%	0%
Skills and innovation	▼	100%	0%	0%
Environment	▼	100%	0%	0%
Internationalization	▼	100%	0%	0%

**Table 12. SBA principles: Simulations for Ireland, Italy, Latvia**

Probabilistic assessment				
<b>Ireland</b>	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	▲	0%	50%	50%
Second chance	▲	0%	0%	100%
Think small first	▬	31%	69%	0%
Responsive administration	▲	0%	50%	50%
State aid and public procurement	▬	59%	41%	0%
Access to finance	▼	97%	3%	0%
Single market	▲	0%	55%	45%
Skills and innovation	▲	0%	30%	70%
Environment	▲	0%	60%	40%
Internationalization	▬	0%	100%	0%
Probabilistic assessment				
<b>Italy</b>	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	▼	94%	7%	0%
Second chance	▼	100%	0%	0%
Think small first	▬	50%	49%	1%
Responsive administration	▼	79%	21%	0%
State aid and public procurement	▬	50%	35%	15%
Access to finance	▼	100%	0%	0%
Single market	▼	100%	0%	0%
Skills and innovation	▼	100%	0%	0%
Environment	▬	71%	29%	0%
Internationalization	▼	100%	0%	0%
Probabilistic assessment				
<b>Latvia</b>	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	▼	98%	2%	0%
Second chance	▬	24%	76%	0%
Think small first	▬	0%	100%	0%
Responsive administration	▲	0%	50%	50%
State aid and public procurement	▲	0%	51%	49%
Access to finance	▲	0%	8%	92%
Single market	▲	0%	0%	100%
Skills and innovation	▼	100%	0%	0%
Environment	▼	30%	70%	0%
Internationalization	▬	0%	93%	7%

**Table 13. SBA principles: Simulations for Lithuania, Luxembourg, Malta**

Probabilistic assessment				
<b>Lithuania</b>	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	🟡	1%	100%	0%
Second chance	🟡	0%	100%	0%
Think small first	🟡	0%	100%	0%
Responsive administration	🟡	1%	99%	0%
State aid and public procurement	🟢	0%	0%	100%
Access to finance	🟢	0%	61%	39%
Single market	🟡	0%	100%	0%
Skills and innovation	🔴	100%	0%	0%
Environment	🔴	100%	0%	0%
Internationalization	🟡	0%	100%	0%

Probabilistic assessment				
<b>Luxembourg</b>	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	🔴	100%	0%	0%
Second chance	🟡	0%	100%	0%
Think small first	🟢	0%	0%	100%
Responsive administration	🟡	1%	100%	0%
State aid and public procurement	🟡	51%	49%	0%
Access to finance	🟢	50%	0%	50%
Single market	🟢	0%	1%	99%
Skills and innovation	🟡	0%	100%	0%
Environment	🟡	9%	91%	0%
Internationalization	🔴	78%	22%	0%

Probabilistic assessment				
<b>Malta</b>	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	🟡	55%	45%	0%
Second chance		0%	100%	0%
Think small first		0%	100%	0%
Responsive administration		81%	19%	0%
State aid and public procurement	🔴	90%	10%	0%
Access to finance	🟢	0%	50%	50%
Single market	🟢	0%	0%	100%
Skills and innovation	🔴	100%	0%	0%
Environment	🔴	100%	0%	0%
Internationalization		0%	100%	0%

Table 14. SBA principles: Simulations for Netherlands, Poland, Portugal

Probabilistic assessment				
Netherlands	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	🟡	0%	98%	2%
Second chance	🟢	0%	10%	90%
Think small first	🟢	0%	0%	100%
Responsive administration	🟡	54%	46%	0%
State aid and public procurement	🟢	0%	51%	49%
Access to finance	🔴	96%	4%	0%
Single market	🔴	55%	45%	0%
Skills and innovation	🟢	0%	48%	52%
Environment	🟢	0%	40%	60%
Internationalization	🟢	0%	0%	100%
Probabilistic assessment				
Poland	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	🟢	0%	34%	66%
Second chance	🔴	98%	2%	0%
Think small first	🔴	100%	0%	0%
Responsive administration	🔴	100%	0%	0%
State aid and public procurement	🟡	50%	50%	0%
Access to finance	🟢	50%	0%	50%
Single market	🔴	100%	0%	0%
Skills and innovation	🔴	100%	0%	0%
Environment	🟢	0%	19%	81%
Internationalization	🔴	100%	0%	0%
Probabilistic assessment				
Portugal	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	🟡	0%	90%	10%
Second chance	🟡	0%	100%	0%
Think small first	🟢	5%	66%	29%
Responsive administration	🟢	0%	50%	50%
State aid and public procurement	🔴	100%	0%	0%
Access to finance	🔴	100%	0%	0%
Single market	🟡	54%	46%	0%
Skills and innovation	🟡	50%	50%	0%
Environment	🟡	28%	72%	0%
Internationalization	🟡	0%	100%	0%

Table 15. SBA principles: Simulations for Romania, Slovakia, Slovenia

Probabilistic assessment				
<b>Romania</b>	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	▲	0%	46%	54%
Second chance	▼	91%	9%	0%
Think small first		93%	8%	0%
Responsive administration	▼	98%	2%	0%
State aid and public procurement	▬	67%	33%	0%
Access to finance	▼	100%	0%	0%
Single market	▬	50%	50%	0%
Skills and innovation	▼	100%	0%	0%
Environment	▼	100%	0%	0%
Internationalization	▼	100%	0%	0%
Probabilistic assessment				
<b>Slovakia</b>	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	▼	100%	0%	0%
Second chance	▼	100%	0%	0%
Think small first	▼	100%	0%	0%
Responsive administration	▬	1%	99%	0%
State aid and public procurement	▬	61%	39%	0%
Access to finance	▬	44%	56%	0%
Single market	▲	0%	0%	100%
Skills and innovation	▼	100%	0%	0%
Environment	▬	18%	82%	0%
Internationalization	▼	100%	0%	0%
Probabilistic assessment				
<b>Slovenia</b>	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	▬	0%	100%	0%
Second chance	▼	82%	18%	0%
Think small first	▲	0%	72%	28%
Responsive administration	▬	6%	94%	0%
State aid and public procurement	▲	50%	0%	50%
Access to finance	▬	29%	71%	0%
Single market	▬	0%	100%	0%
Skills and innovation	▲	0%	68%	32%
Environment	▬	0%	100%	0%
Internationalization	▬	50%	47%	3%

**Table 16. SBA principles: Simulations for Spain, Sweden, United Kingdom**

Probabilistic assessment				
Spain	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	▼	52%	48%	0%
Second chance	▬	0%	100%	0%
Think small first	▲	0%	50%	50%
Responsive administration	▬	0%	100%	0%
State aid and public procurement	▼	100%	0%	0%
Access to finance	▼	100%	0%	0%
Single market	▼	100%	0%	0%
Skills and innovation	▼	100%	0%	0%
Environment	▬	0%	99%	1%
Internationalization	▼	100%	0%	0%
Probabilistic assessment				
Sweden	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	▲	0%	51%	49%
Second chance	▬	0%	100%	0%
Think small first	▲	0%	0%	100%
Responsive administration	▲	0%	50%	50%
State aid and public procurement	▲	50%	0%	50%
Access to finance	▲	0%	0%	100%
Single market	▼	100%	0%	0%
Skills and innovation	▲	0%	3%	97%
Environment	▬	0%	100%	0%
Internationalization	▲	0%	0%	100%
Probabilistic assessment				
United Kingdom	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	▬	0%	100%	0%
Second chance	▲	0%	0%	100%
Think small first	▬	0%	100%	0%
Responsive administration	▲	0%	50%	50%
State aid and public procurement	▲	0%	50%	50%
Access to finance	▬	0%	100%	0%
Single market	▬	49%	52%	0%
Skills and innovation	▲	0%	7%	93%
Environment	▲	0%	0%	100%
Internationalization	▲	0%	50%	50%

**Table 17. SBA principles: Simulations for Albania, Croatia, FYROM**

Probabilistic assessment			
<b>Albania</b> SBA	Below EU	Close to EU	Above EU
Entrepreneurship	0%	55%	45%
Second chance	0%	100%	0%
Think small first	0%	82%	18%
Responsive administration	100%	0%	0%
State aid and public procurement	40%	32%	28%
Access to finance	0%	79%	21%
Single market	0%	0%	100%
Skills and innovation	100%	0%	0%
Environment	100%	0%	0%
Internationalization	67%	33%	0%
Probabilistic assessment			
<b>Croatia</b> SBA	Below EU	Close to EU	Above EU
Entrepreneurship	100%	0%	0%
Second chance	100%	0%	0%
Think small first	93%	7%	0%
Responsive administration	0%	100%	0%
State aid and public procurement	73%	27%	0%
Access to finance	0%	100%	0%
Single market	100%	0%	0%
Skills and innovation	50%	50%	0%
Environment	69%	31%	0%
Internationalization	100%	0%	0%
Probabilistic assessment			
<b>FYROM</b> SBA	Below EU	Close to EU	Above EU
Entrepreneurship	0%	50%	50%
Second chance	0%	100%	0%
Think small first	0%	100%	0%
Responsive administration	0%	52%	48%
State aid and public procurement	50%	0%	50%
Access to finance	0%	64%	36%
Single market	0%	100%	0%
Skills and innovation	100%	0%	0%
Environment	100%	0%	0%
Internationalization	77%	23%	0%

**Table 18. SBA principles: Simulations for Iceland, Israel, Liechtenstein**

Probabilistic assessment				
<b>Iceland</b>	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	▲	0%	0%	100%
Second chance	▬	45%	54%	1%
Think small first	▼	73%	27%	0%
Responsive administration	▲	0%	50%	50%
State aid and public procurement	▬	71%	29%	0%
Access to finance	▲	0%	50%	50%
Single market		100%	0%	0%
Skills and innovation	▲	0%	48%	52%
Environment	▬	0%	100%	0%
Internationalization	▼	100%	0%	0%
Probabilistic assessment				
<b>Israel</b>	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	▲	0%	52%	48%
Second chance	▼	100%	0%	0%
Think small first	▼	100%	0%	0%
Responsive administration	▼	100%	0%	0%
State aid and public procurement		0%	50%	50%
Access to finance	▲	0%	50%	50%
Single market		0%	8%	92%
Skills and innovation	▬	2%	98%	0%
Environment	▼	100%	0%	0%
Internationalization	▲	0%	0%	100%
Probabilistic assessment				
<b>Liechtenstein</b>	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	▬	0%	100%	0%
Second chance	▬	0%	100%	0%
Think small first	▬	0%	100%	0%
Responsive administration	▬	0%	100%	0%
State aid and public procurement	▬	0%	100%	0%
Access to finance	▲	0%	49%	52%
Single market	▼	100%	0%	0%
Skills and innovation	▬	50%	50%	0%
Environment	▲	0%	0%	100%
Internationalization	▬	0%	100%	0%

**Table 19. SBA principles: Simulations for Montenegro, Norway, Serbia**

Probabilistic assessment				
<b>Montenegro</b>	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	▲	0%	51%	49%
Second chance	▬	0%	100%	0%
Think small first		5%	95%	0%
Responsive administration	▼	100%	0%	0%
State aid and public procurement		53%	47%	0%
Access to finance	▬	0%	99%	1%
Single market		0%	41%	59%
Skills and innovation		100%	0%	0%
Environment	▼	100%	0%	0%
Internationalization	▬	0%	100%	0%
Probabilistic assessment				
<b>Norway</b>	SBA	Below EU	Close to EU	Above EU
Entrepreneurship	▲	0%	50%	50%
Second chance	▲	0%	0%	100%
Think small first	▬	0%	100%	0%
Responsive administration	▲	0%	0%	100%
State aid and public procurement		0%	58%	42%
Access to finance	▲	0%	35%	65%
Single market	▼	55%	45%	0%
Skills and innovation	▲	50%	9%	41%
Environment	▲	0%	52%	48%
Internationalization	▲	0%	0%	100%
Probabilistic assessment				
<b>Serbia</b>	SBA	Below EU	Close to EU	Above EU
Entrepreneurship		0%	100%	0%
Second chance	▼	100%	0%	0%
Think small first		100%	0%	0%
Responsive administration	▼	100%	0%	0%
State aid and public procurement		0%	50%	50%
Access to finance	▬	0%	100%	0%
Single market		0%	97%	3%
Skills and innovation	▼	100%	0%	0%
Environment	▼	100%	0%	0%
Internationalization	▼	100%	0%	0%

Table 20. SBA principles: Simulations for Turkey

		Probabilistic assessment		
Turkey SBA		Below EU	Close to EU	Above EU
Entrepreneurship ▲		0%	0%	100%
Second chance ▼		98%	2%	0%
Think small first ▼		100%	0%	0%
Responsive administration ▬		0%	97%	3%
State aid and public procurement		100%	0%	0%
Access to finance ▬		0%	100%	0%
Single market		100%	0%	0%
Skills and innovation ▼		100%	0%	0%
Environment ▬		37%	63%	0%
Internationalization ▼		100%	0%	0%

## 6. Key messages for Europe

This section aims to discuss data-driven narratives on the European landscape of SMES that go beyond the information already offered by DG ENTR on the SBA country factsheets.

### *SBA principles – looking across them*

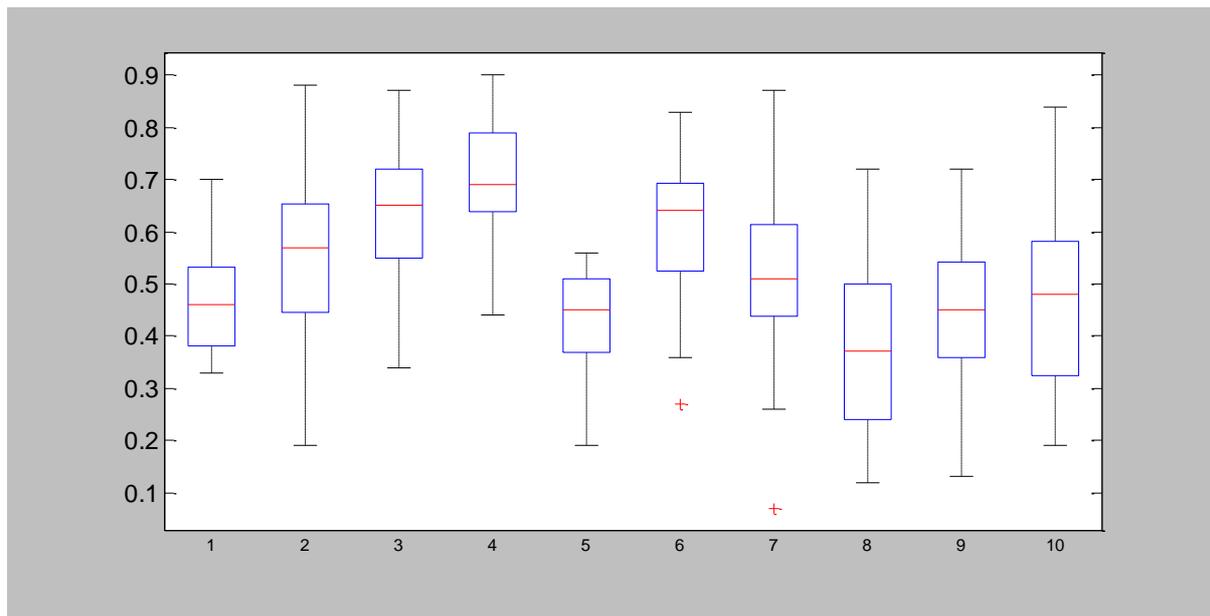
The 2012 SBA profiles can be further used to identify issues in which European SMEs performance is headed in the right direction and others that are not. Figure 1 shows the distribution of country scores by principle for the 27 EU Member States plus the 10 non-EU countries altogether. The red line is the median across all countries and the boxes span from the 25<sup>th</sup> to the 75<sup>th</sup> percentile. The whole distribution of the scores is displayed by the vertical lines, except for the values that lay 1.5 times<sup>24</sup> outside the interquartile range (displayed with crosses). This plot demonstrates that there is considerable differentiation among the SBA principles in terms of their dominant policy dynamics. On three principles – Responsive administration, Think small first and Access to finance – most countries are performing well; yet Greece could be considered as a hotspot on Access to finance. On the contrary, on other three principles – Second chance, Single market, and Internationalization– the spread of countries' achievements is much wider. For issues related to these three principles, European policies need to find ways to spread best practices on SMEs already proven to work in some countries. Among other countries, best practices on Second chance are found in Finland, Ireland, and Norway<sup>25</sup>. Similarly, best practices on Single market are found in Slovakia and Malta. On Internationalization, countries such as Denmark, Norway and Estonia can be studied for best practices. Finally, there are issues such as State aid and public procurement, and Skills and innovation, for which most European countries have relatively poor scores. For these SBA principles, there is a compelling need to find policy processes that are transformational and that permit movement into achievements not currently prevalent in most European countries.

---

<sup>24</sup> The interquartile range is the difference between the upper (75% of values) and the lower (25% of values) quartiles. The value 1.5 corresponds to approximately  $\pm 2.7$  standard deviations and 99.3 coverage if the data are normally distributed.

<sup>25</sup> See SBA country factsheets for more details, available at: [http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/performance-review/index\\_en.htm#maplinks](http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/performance-review/index_en.htm#maplinks)

**Figure 1. The distribution of country scores by SBA principle (most recent year)**

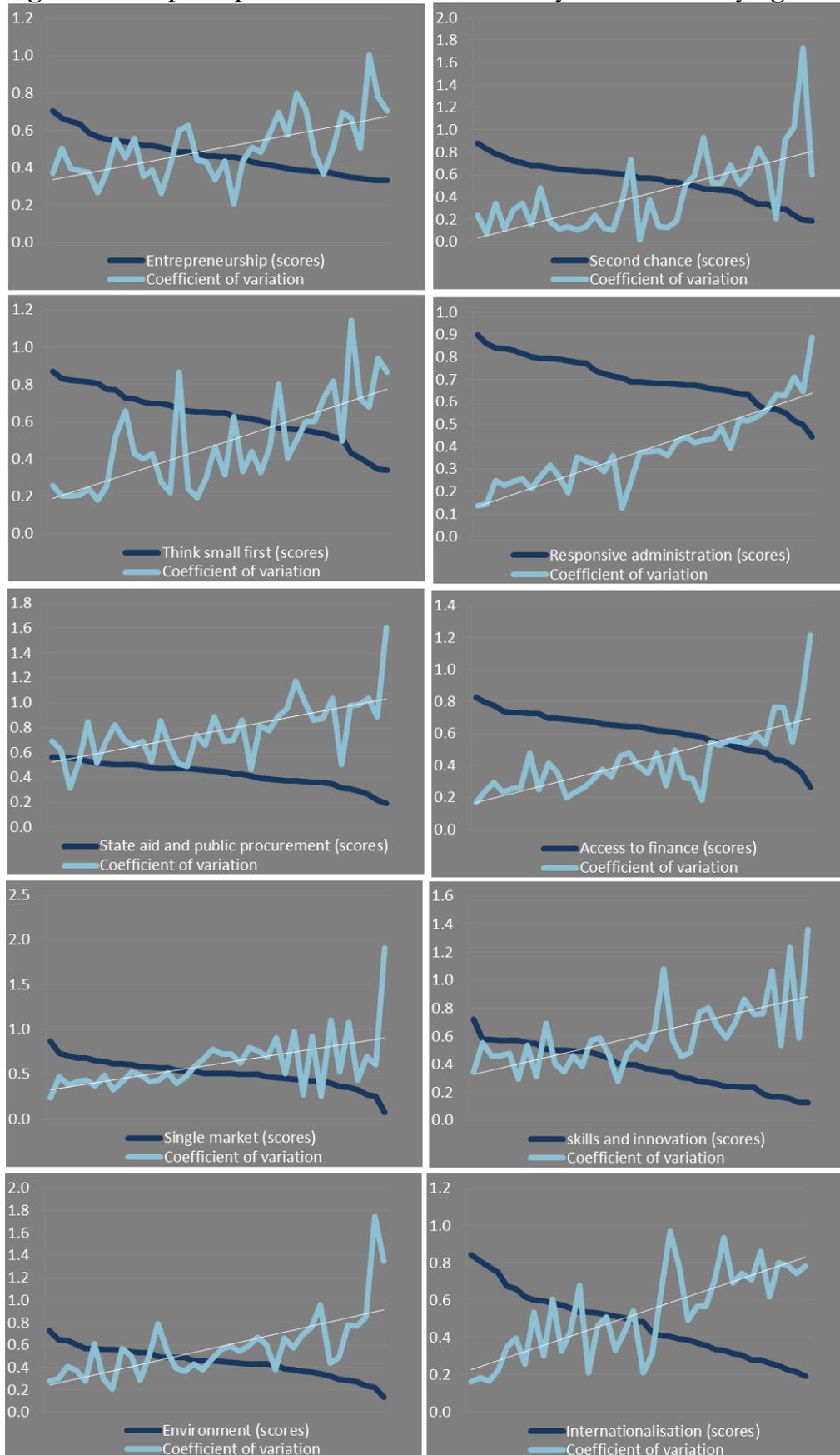


Notes: (1) The x-axis refers to: 1. Entrepreneurship, 2. Second Chance, 3. Think Small First, 4. Responsive Administration, 5. State aid and Public procurement, 6. Access to Finance, 7. Single Market, 8. Skills and Innovation, 9. Environment, 10. Internationalization. (2) The red line is the median across all 37 countries (27 EU Member States plus Albania, Croatia, FYROM, Iceland, Israel, Liechtenstein, Montenegro, Norway, Serbia and Turkey. and the boxes span from the 25th to the 75th percentile of the scores calculated for the most recent dataset. The whole distribution of the scores is displayed by the vertical lines, except for the values that lay 1.5 times outside the interquartile range (displayed with crosses). These are: Greece on Access to finance (principle 6) and Iceland on Single Market (principle 7).

### *SBA principles – looking within them*

Next, we study the relationship between an SBA principle score and the variability of the underlying indicators, i.e. what the relationship is, if any, between an SBA principle score and a balanced performance in the underlying indicators. While country scores on the SBA principles provide a quantitative indication of SMEs achievement, changes in the principles' variability convey information on the quality of the changes: an increase in SMEs performance may be achieved by improving performance in specific indicators, but also by reducing gaps in performance between indicators. In order to measure the variability of the underlying indicators we will calculate their coefficient of variation, which is the ratio of the standard deviation across the indicators' scores for a given country in an SBA principle and a country's score on that principle.

**Figure 2. SBA principles scores and the variability of their underlying indicators**



Note: The 37 countries are ordered by the SBA principle score (most recent year dataset).

As can be seen in Figure 2, generally countries with higher levels of SMEs performance in an SBA principle exhibit less variability, since they tend to achieve high values in all the underlying indicators. The opposite holds generally true for countries with lower levels of achievement, see the trend. This reflects the fact that countries with lower levels of achievement generally display larger discrepancies in performance between indicators, and that focusing only in particular indicators while allowing performance gaps between indicators yields only marginal results. The highest value for the Pearson correlation coefficient between an SBA principle and its coefficient of variation is found for Responsive administration (-0.92), which reflects a very high degree of negative association between that SBA principle and the variability of its nine indicators. Overall, for five principles –Think small first, Responsive administration, Access to finance, Environment, and Internationalization– the correlation is 0.75 or higher, whilst for the remaining five principles the correlation is -0.58 to -0.70.

## 7. Conclusions

The Small Business Act for Europe (SBA) reflects the Commission's political will to recognize the central role of SMEs in the EU economy and for the first time puts into place a comprehensive SME policy framework for the EU and its Member States. On an annual basis since 2008, the European Commission's Directorate-General for Enterprise and Industry (DG ENTR) produces the SBA country factsheets that serve as an additional source of information designed to improve evidence-based policy making, along ten established (COM(2008) 394 final) principles: (1) Entrepreneurship, (2) Second chance, (3) Think small first, (4) Responsive administration, (5) State aid and public procurement, (6) Access to finance, (7) Single market, (8) Skills and innovation, (9) Environment, and (10) Internationalization.

DG ENTR has operationalized these broad dimensions of SMEs achievement by populating them with three to nine indicators (per principle). For the 2012 release of the SBA factsheets, a total of 68 indicators were selected from 21 sources, including the Flash Eurobarometer on Entrepreneurship, the World Bank Doing Business, the OECD Product market regulations database, the European Payment Index, the European Central Bank database on interest rates, and other. These ten dimensions are presented together but not aggregated into an overall index, as the focus is meant to be at the principles and their underlying indicators and not at a single number.

The JRC's Unit of Econometrics and Applied Statistics at the Institute for the Protection and Security of the Citizen (IPSC) has calculated and analyzed the 2012 SBA dimensions based on in-house methodology in order to ensure their transparency and reliability. This should enable policymakers to derive more accurate and meaningful conclusions.

This report has presented in detail the ten-dimensional framework of the SBA, the rationale behind each principle and the underlying indicators that were selected by DG ENTR after consultation with national experts. It discussed the methodological approach used to calculate the ten SBA principles. In brief, raw data were first checked for reporting errors and outliers that could strongly bias the results were treated. Missing data were estimated using a time-series cross-sectional algorithm. The SBA principles were finally calculated as simple averages of the normalized (with min-max) indicators per country for 2007-2012 (whereby highly correlated indicators were counted as a single indicator. Compound annual growth rates were calculated per principle and country.

The statistical coherence of the SBA framework was assessed based on an analysis of the covariance structure within and across the principles. The analysis suggested that the SBA principles are indeed multidimensional and the underlying indicators capture very diverse aspects of SMEs achievements with little overlap of information between them. It also offered statistical arguments as to why the ten SBA principles should not be further aggregated into an overall index. The reason is that any aggregate measure of the ten SBA principles would only capture less than 37% of the total variance. Instead, it is interesting to study the “statistical” grouping of these ten principles into three latent dimensions: (a) Second chance, Think small first, Responsive administration, Skills and innovation and Environment, (b) State aid and public procurement, Access to finance, Single market, and Internationalization, and (c) Entrepreneurship. The added value from an analysis of these three latent dimensions would only be derived provided that a meaningful interpretation of these latent dimensions can be made by the relevant experts on the field.

An additional analysis of the robustness of country classifications with respect to the EU average for each principle was undertaken with a view to examine to what extent the results depend on the selected set of indicators or on the methodological judgments on the estimation of missing data, normalization, weighting and aggregation, which were made during the development of the SBA principles. Overall, country classifications with respect to the EU average in the 2012 SBA

factsheets are supported by the simulations and these classifications are robust for 75% of the cases.

Extending the discussions offered in the 2012 SBA country factsheets, this report offered key messages on the European landscape of the SMEs achievements. These are summarized in the following.

- There is considerable differentiation among the SBA principles in terms of their dominant policy dynamics.
- On Responsive administration, Think small first and Access to finance, most countries are performing well; yet Greece could be considered as a hotspot on Access to finance.
- Contrarily, on Second chance, Single market, and Internationalization, the spread of countries' achievements is much wider. For issues related to these three principles, European policies need to find ways to spread best practices on SMEs already proven to work in some countries. Among other countries, best practices on Second chance are found in Finland, Ireland, and Norway. Similarly, best practices on Single market are found in Slovakia and Malta. On Internationalization, countries such as Denmark, Norway and Estonia can be studied for best practices.
- On State aid and public procurement, and Skills and innovation, most European countries have relatively poor scores. For these SBA principles, there is a compelling need to find policy processes that are transformational and that permit movement into achievements not currently prevalent in most European countries.
- Countries with higher levels of SMEs performance in an SBA principle exhibit less variability, since they tend to achieve high values in most of the underlying indicators. The opposite holds generally true for countries with lower levels of achievement, which reflects the fact that countries with lower levels of achievement generally display larger discrepancies in performance between indicators, and that focusing only in particular indicators while allowing performance gaps between indicators yields only marginal results. This phenomenon is most evident on Responsive administration, Think small first, Access to finance, Environment, and Internationalization.

The calculation of 2012 SBA principles has moved from a one-way design process of the previous versions to an iterative process with the JRC (since 2011) with a view to laying the foundation for a sound tool. This report has presented the refinements made and provided an additional assessment of the conceptual/statistical coherence and uncertainty analysis in the final

tool. Notwithstanding the statistical tests described above, it is important to mention that the SBA framework will continue to be refined as better data, more assessments, and new relevant policy measures are implemented in Europe.

## 8. References

- Blankers, Matthijs, Maarten W.J. Koeter, and Gerard M. Schippers. 2010. Missing data approaches in eHealth research: Simulation study and a tutorial for nonmathematically inclined researchers. *Journal of Medical Internet Research* 12 (5):e54.
- Groeneveld, R. A. and G. Meeden. 1984. Measuring skewness and kurtosis. *The Statistician* 33: 391–399.
- Honaker, J., and G. King. 2010. What to do about missing values in time-series cross-section data. *American Journal of Political Science* 54 (2):561-581.
- Honaker, James, Gary King, and Matthew Blackwell. 2012. *AMELLA II: A program for missing data*. Cambridge, MA: Harvard University.
- King, G., J. Honaker, A. Joseph, and K. Scheve. 2001. Analyzing incomplete political science data: An alternative algorithm for multiple imputation. *American Political Science Review* 95 (1):49-70.
- 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.
- Munda, G. 2008. *Social Multi-Criteria Evaluation for a Sustainable Economy*. Berlin Heidelberg: Springer-Verlag.
- OECD/EC JRC. 2008. *Handbook on Constructing Composite Indicators: Methodology and User Guide*. Paris: OECD.
- Paruolo, P., Saltelli, A., Saisana, M. 2013. Ratings and rankings: Voodoo or Science? *Journal of the Royal Statistical Society A*, 176 (2):1-26.
- 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.

European Commission

EUR 25577 EN – Joint Research Centre – Institute for the Protection and Security of the Citizen

Title: **Monitoring SMEs' performance in Europe- Indicators fit for purpose**

Author: Michaela Saisana

Luxembourg: Publications Office of the European Union

2012 – 52 pp. – 21.0 x 29.7 cm

EUR – Scientific and Technical Research series – ISSN 1831-9424 (online), ISSN 1018-5593 (print)

ISBN 978-92-79-27202-8

doi:10.2788/62756

### **Abstract**

The Small Business Act for Europe (SBA) reflects the Commission's political will to recognize the central role of SMEs in the EU economy. The calculation of 2012 SBA principles has moved from a one-way design process of the previous versions to an iterative process with the JRC (since 2011) with a view to laying the foundation for a sound tool. This report presents the SBA framework, methodology, the refinements made and provides an additional assessment of the conceptual/statistical coherence and uncertainty analysis in the final tool. Extending the discussions offered in the 2012 SBA country factsheets, this report offers key messages on the European landscape of the SMEs achievements, such as the considerable differentiation among the SBA principles in terms of their dominant policy dynamics.

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new standards, methods and tools, and sharing and transferring its know-how to the Member States and international community.

Key policy areas include: environment and climate change; energy and transport; agriculture and food security; health and consumer protection; information society and digital agenda; safety and security including nuclear; all supported through a cross-cutting and multi-disciplinary approach.

