Fondazione Eni Enrico Mattei

FEEM SUSTAINABILITY INDEX

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Report 2009

FEEM Sustainability Index 2009

This 2009 Annual Report presents a series of results based on simulations conducted inside the FEEM dynamic general equilibrium model ICES SI, in which sustainability indicators are developed and projected over time to compute the FEEM Sustainability Index (FEEM SI) for the entire 2009-2020 time span. ICES SI is an extension of ICES (Intertemporal Computable Equilibrium System) tailored to incorporate the data needed to build the sustainability indicators of the FEEM SI. ICES SI is based on the GTAP framework and incorporates all the basic features of a general equilibrium model with recursive dynamics.

The baseline scenario for the FEEM SI has been simulated on the basis of specific assumptions aimed at reproducing an intermediate growth level in a world where no significant policy has been implemented. In the economic sphere, the GDP growth follows an intermediate growth path, whilst the social sphere incorporates a medium-variant assumption for population growth, and the environmental sphere considers a high emissions growth scenario corresponding to the absence of any climate policy implementation. This baseline scenario induces a natural increase in economic sustainability that explains the generally increasing trend in the overall sustainability of countries. Nevertheless, some countries do show a decreasing trend, due to the interaction across the three sustainability components.

All indicators of the FEEM SI have been calculated under this baseline scenario and used to compute both the FEEM SI and its main components, to provide an evaluation of sustainability in the absence of any political intervention aimed at improving the sustainability of countries.

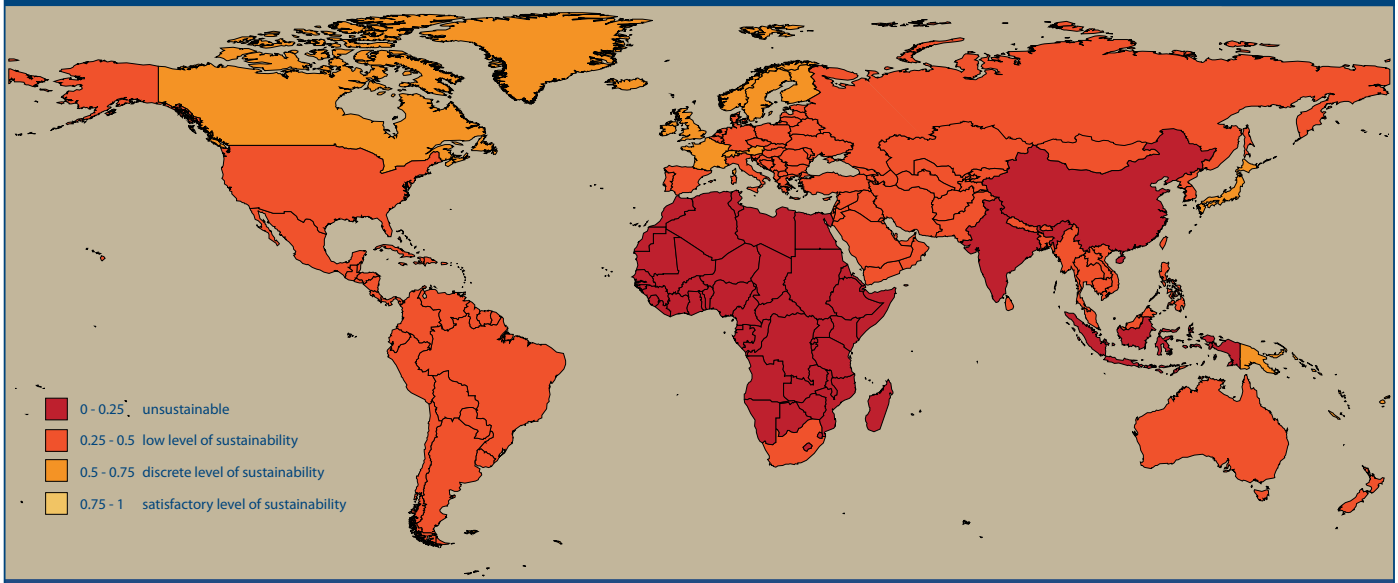
The FEEM SI ranking for 2009 shows developed countries outranking developing ones, with only rare exceptions. Only two non-European countries - Canada (CAN) and Japan (JPN) – make the top ten, while only one European region – Rest of Federal Soviet Union (RoFSU) - makes the worst ten. Sweden is the most sustainable country according to the FEEM SI 2009, with a significant mark-up from Finland, the second most sustainable country. Africa (AFR) closes the 2009 FEEM SI ranking with a relevant gap from other countries in the closing positions. In the current aggregation methodology, countries that rank high in all subcomponents have an advantage over countries that outperform others in only one subcomponent, which explains the relatively low ranking of USA and Australia (AUS), both having low environmental performances.

Rank	Country	FEEM SI	Rank	Country	FEEM SI	Rank	Country	FEEM SI	Rank	Country	FEEM SI
1	SWE	0.669	11	DNK	0.481	21	AUS	0.398	31	MEast	0.308
2	FIN	0.627	12	NZL	0.475	22	BRA	0.395	32	RoAsia	0.299
3	CAN	0.597	13	BNLX	0.465	23	PRT	0.392	33	SEA	0.288
4	UKI	0.569	14	USA	0.458	24	GCM	0.380	34	RoFSU	0.278
5	AUT	0.567	15	ITA	0.454	25	ARG	0.372	35	RoLA	0.275
6	CHE	0.566	16	RoEU	0.446	26	TUR	0.361	36	CHN	0.230
7	FRA	0.524	17	RUS	0.439	27	POL	0.353	37	NorthAFR	0.204
8	JPN	0.511	18	ESP	0.410	28	ZAF	0.343	38	IDN	0.198
9	NIR	0.510	19	Baltic	0.406	29	BUL	0.334	39	IND	0.189
10	GER	0.495	20	RoE	0.403	30	MEX	0.322	40	AFR	0.136

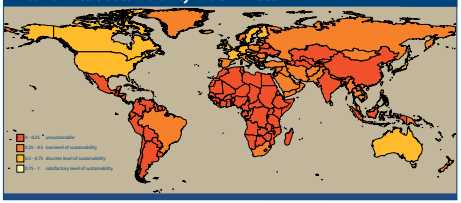
AFR: African countries except Northern Africa and South Africa; **ARG**: Argentina; **AUS**: Australia; **AUT**: Austria; **Baltic:** Estonia, Latvia & Lithuania; **BNLX**: Benelux; **BRA**: Brazil; **BUL**: Bulgaria; **CAN**: Canada; **CHE**: Switzerland; **CHN**: China & Hong Kong; **DNK**: Denmark; **ESP**: Spain; **FIN**: Finland; **FRA**: France; **GCM**: Greece, Cyprus & Malta; **GER**: Germany; **IDN**: Indonesia; **IND**: India; **ITA**: Italy; **JPN**: Japan; **MEast**: Middle East; **MEX**: Mexico; **NIR**: Norway, Iceland e Rest of the World; **NorthAfr**: North Africa; **NZL**: New Zealand; **POL**: Poland; **PRT**: Portugal; **RoAsia**: Rest of Asia; **RoE**: Rest of Europe; **RoEU**: Rest of European Union; **RoFSU**: Rest of Former Soviet Union; **RoLA**: Rest of Latin America; **RUS**: Russia; **SEA**: South East Asia; **SWE**: Sweden; **TUR**: Turkey; **UKI**: United Kingdom & Ireland; **USA**: United States of America; **ZAF**: South Africa

The FEEM Sustainability Maps provide an overview of the performance of the different world regions, which is further illustrated in the maps showing the sustainability scores for the three subcomponents - economic, social and environmental.

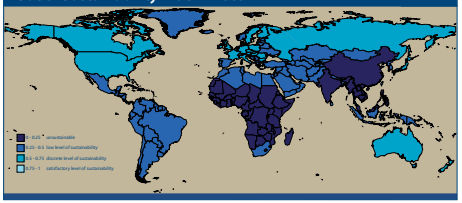
FEEM Sustainability Index - 2009



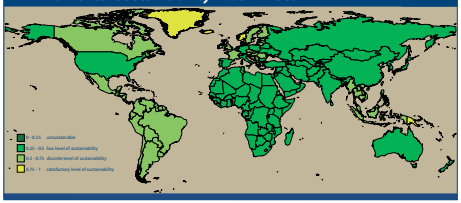
Economics Sustainability Index - 2009



Social Sustainability Index - 2009



Enviromental Sustainability Index - 2009



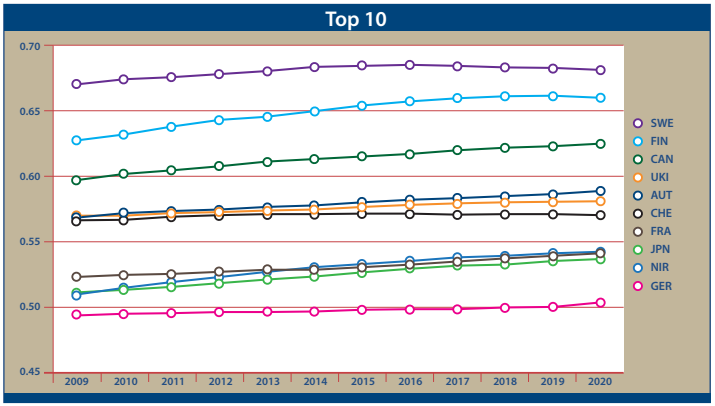
www.feemsi.org

For more information on the construction of the FEEM SI or to explore its potential in providing sustainability projections and ranking for the years 2009-2020, please visit us at www.feemsi.org.
You will also find an interactive area where you can look up specific countries or sublevels of the FEEM Sustainability Index.

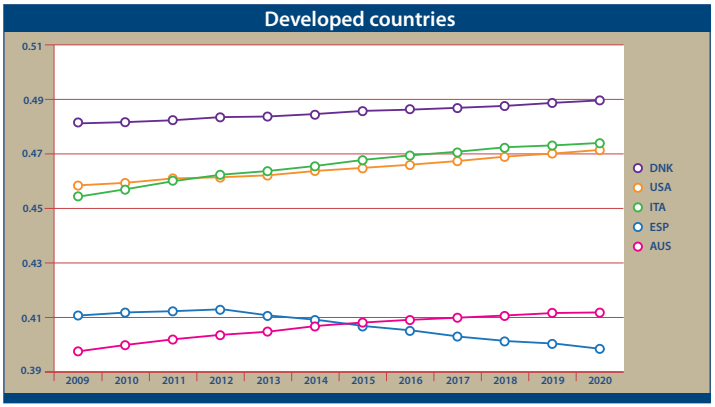
The FEEM Sustainability Index over time

The ability of the ICES SI model to predict indicators in time allows computing the FEEM SI over time under the baseline scenario assumptions, giving an overview of future time trend in the sustainability of countries in the absence of any intervention. The following graphs show the time profile of sustainability (FEEM SI) of the top 10 regions, a subset of industrialised countries with intermediate sustainability levels, and the bottom 10 regions included in the analysis.

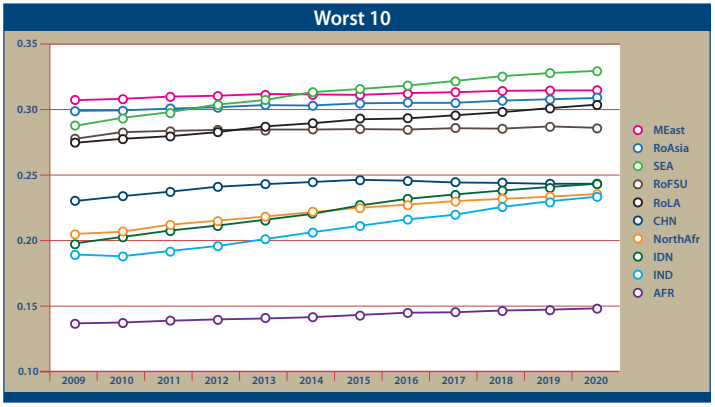
The graph shows that Sweden outperforms all the other regions throughout the entire time frame of the analysis, although its mark-up from the score of the second most sustainable country shrinks slightly over time according to the FEEM SI. Denmark and Canada remain steadily in control of the second and third position respectively, while the relative positions of the other top ten countries are only slightly more variable.



This graph shows the performance of a subgroup of developed countries, which did not make the top 10 over the entire time span considered. The relative ranking of the five regions undergoes several changes throughout the time frame considered, with the USA and Italy, and Spain and Austria swapping positions. Norway is the only country that constantly outperforms all the other countries considered.



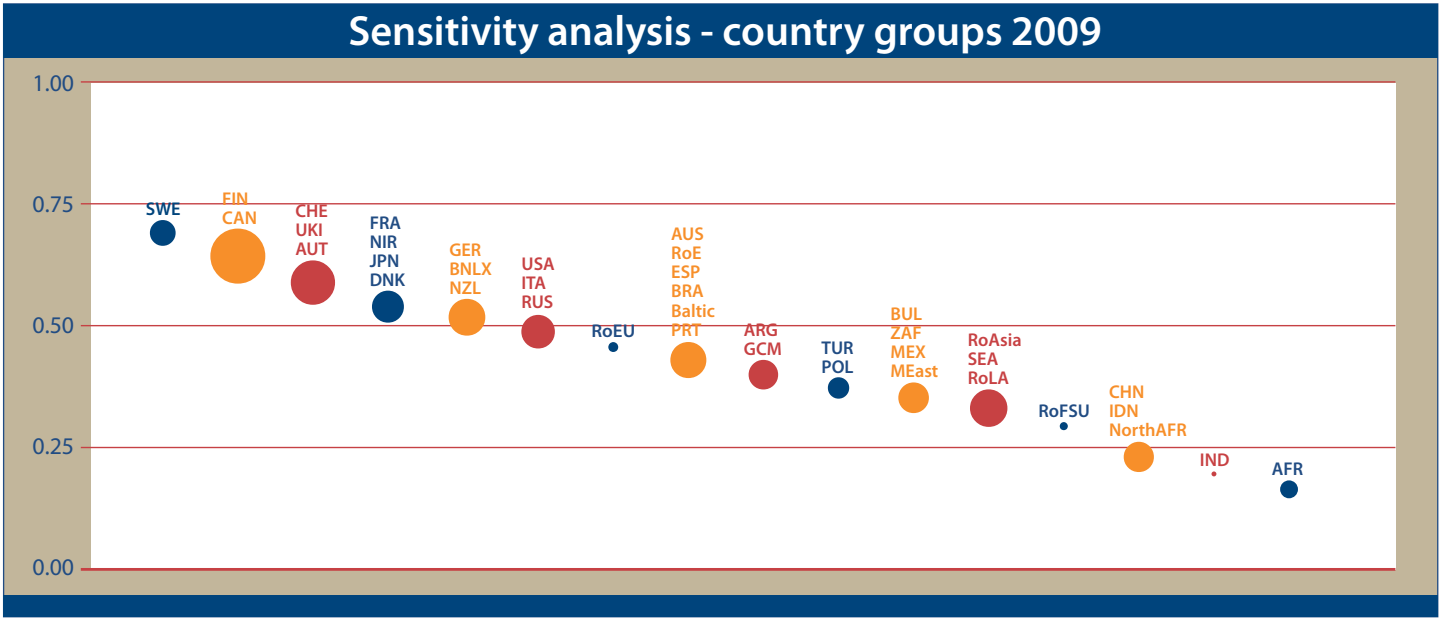
The worst performers, African countries except Northern and South Africa (AFR) and India, ranked lowest throughout the time span, see their relative performance widen further apart in time, with India dramatically raising its overall FEEM SI score due to its outstanding improvement in the economic subcomponent of sustainability. A similar improvement is recorded for South East Asia (SEA) which moves up from the third to the first position in the time frame considered.



Aggregation and sensitivity

The FEEM SI incorporates a non-linear aggregation methodology that focuses specifically on the interrelation between indicators, relying on subjective weights representing interactions across the subgroups of the FEEM SI indicators. These subjective weights represent useful information on synergies or conflicts that may arise across indicators pertaining to different aspects of sustainability. The subjective weights are elicited from the answers to a standardized questionnaire administered to a simulated decision maker with specific characteristics. It is assumed that the decision maker aims at achieving sustainability in all the dimensions, rather than an outstanding performance in one dimension of sustainability to compensate for a poor one in the other dimensions.

In a complex aggregation such as the one used for the FEEM SI, the attitude of the decision maker is a key component of the process. It is thus important to check how robust the ranking actually is to a change in the decision maker's attitude. A variation range is provided for each region of the FEEM SI based on an iteration procedure characterised by reasonable variations in the degree of compensability across indicators of the decision maker. Sensitivity to changes in the aggregation methodology is measured in the following graph, in which countries are grouped in bubbles according to the range of variability of their ranking. The size of the ball is set equal to the variability range of a given group of countries – the difference between the maximum and the minimum score of all countries belonging to the same group. Countries included in the same bubble are statistically equivalent in this sensitivity analysis.



The sensitivity analysis allows us to conclude that reasonable variations in the attitude of the decision makers do not significantly affect the ranking provided for the year 2009. There is more variability midway through the ranking, where the more sensitive countries could gain up to six positions - Australia, Rest of Europe, Spain, Brazil, Baltic countries, Portugal. Nevertheless, most countries vary only around their neighbouring positions.

A policy experiment

The modelling framework used for the construction of the FEEM SI indicators allows for the development of policy scenarios to simulate the effect of different kinds of world policies on the sustainability of countries. The Sustainable Development policy scenario (SD Policy) combines policies aimed at improving a variety of issues relevant to sustainability, which are supposed to enter into force in the year 2010.

The composite policy includes specific actions towards:

- climate change, in the form of a cap-and-trade system based on regional targets defined according to the position of the main developed countries for the COP15, for a final overall reduction of 8% of the emissions in developed countries with respect to 1990 levels;
- education, based on the financial resources necessary to achieve the Millennium development goals (achieve universal primary education);
- health, based on the financial resources necessary to achieve the Millennium development goals (combat HIV/AIDS, malaria and other diseases);
- improved water management, in the form of a 10% water efficiency increase in all countries;
- technology development and transfer, through a subsidy for R&D imposed in developed countries (of an equal 10% to all countries) since 2010, generating an increase up to 5% in 2020 in the productivity of developing countries.

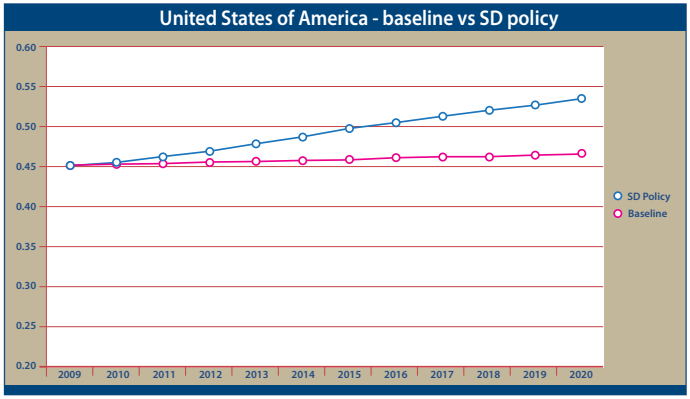
The following table shows the comparison between baseline and policy rankings in 2020, year in which all the policy objectives set in 2010 are supposed to be achieved.

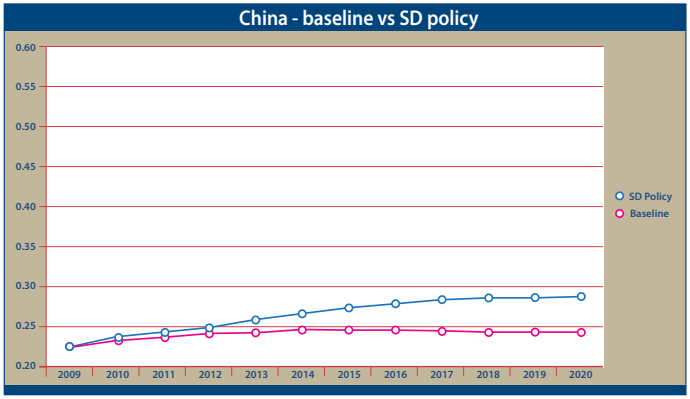
Rank	Baseline 2020	SD Policy 2020			Rank	Baseline 2020	SD Policy 2020			Rank	Baseline 2020	SD Policy 2020			Rank	Baseline 2020	SD Policy 2020		
1	SWE	SWE	=	0	11	NZL	NIR	↓	-3	21	RoE	BUL	↓	-1	31	SEA	ZAF	↑	3
2	FIN	FIN	=	0	12	DNK	USA	↑	2	22	PRT	RoE	↓	-5	32	MEast	MEX	↓	-1
3	CAN	CAN	=	0	13	BNLX	BNLX	=	0	23	ESP	ARG	↓	-2	33	RoAsia	MEast	↑	4
4	AUT	JPN	↓	-1	14	RUS	NZL	↓	-3	24	ARG	POL	↑	1	34	RoLA	RoLA	=	0
5	UKI	AUT	↓	-3	15	ITA	RoEU	↓	-1	25	GCM	ESP	↓	-5	35	RoFSU	CHN	↓	-1
6	CHE	CHE	=	0	16	USA	ITA	↑	4	26	TUR	TUR	=	0	36	IDN	RoFSU	↓	-1
7	FRA	FRA	=	0	17	RoEU	RUS	↑	2	27	BUL	PRT	↑	6	37	CHN	IDN	↑	2
8	NIR	UKI	↓	-3	18	BRA	AUS	↓	-1	28	ZAF	SEA	↓	-3	38	NorthAfr	IND	↓	-1
9	JPN	GER	↑	5	19	Baltic	BRA	↓	-1	29	POL	RoAsia	↑	5	39	IND	NorthAfr	↑	1
10	GER	DNK	↑	1	20	AUS	Baltic	↑	2	30	MEX	GCM	↓	-2	40	AFR	AFR	=	0

Although the same policies have been implemented across all regions, their overall effect differs considerably and causes major shifts in the relative positioning of some regions. Five of the top-10 sustainable countries and four other exceptions do not change their position in the ranking when the composite policy is implemented, while all the other countries notably do so with as much as a 6-position shift in the case of Bulgaria. There are different explanations for the performances of regions under the policy scenario depending on the sustainability structure of the countries: those with only one weak component - like the USA - manage to gain many more positions than countries characterised by lower scores in all the dimensions of sustainability in the baseline scenario. Nevertheless, countries whose performance was driven by one key component - Indonesia for example - are adversely affected by a composite policy enhancing all the dimensions of sustainability, as the resources need to be allocated to all the pillars, and thus partly away from the dimension driving the overall sustainability performance.

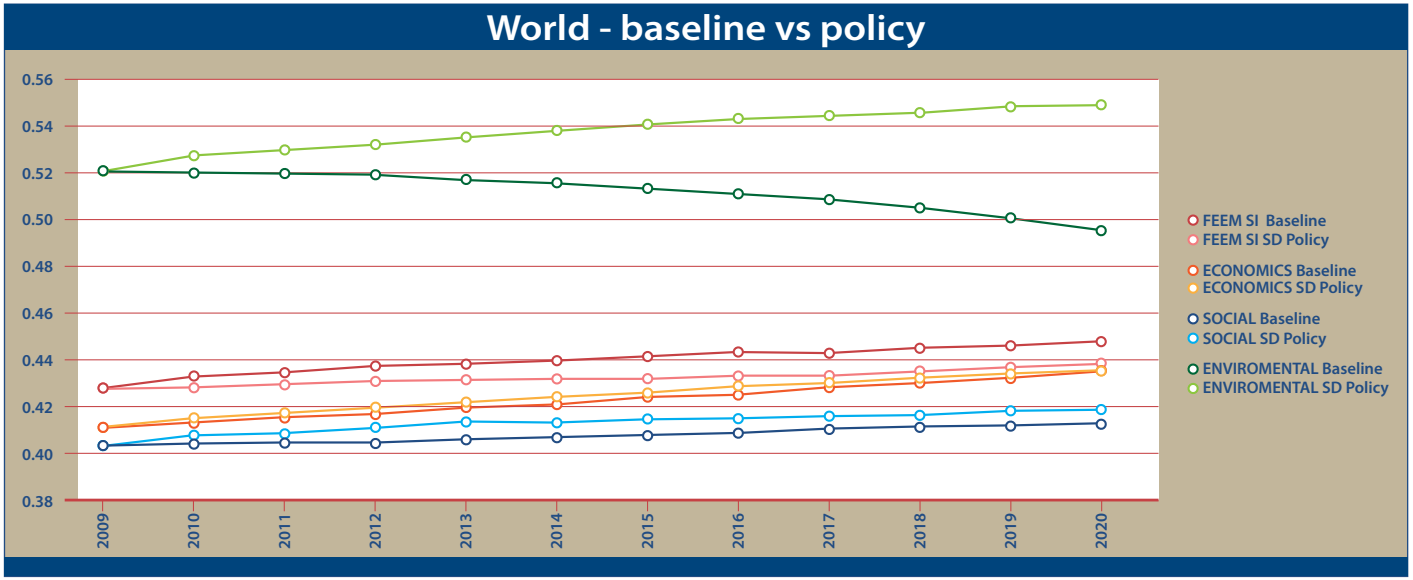
Dynamic effects of policy implementation

How does the introduction of a sustainable development policy affect the time profile of sustainability of countries compared to the baseline scenario? The following graphs show how a selection of regions responds to the implementation of the policy in 2009.





Both United States and China improve their performance in the policy scenario, thanks to a substantial increase in environmental sustainability. While for the USA this improvement compensates a worsening in both social and environmental components, in the case of China these components of sustainability increase too, although to a minor degree.



How does world sustainability increase through the implementation of the composite policy? Sustainability is improved over time both at global level and looking at the single subcomponents, with a more marked improvement in the environmental component.

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