

The TESS Index: A progress indicator for the EU and its Member States

Design and results

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"Dare to take progress further" is the main slogan of the new German government. To mark 100 days of traffic-light government, cep has developed the TESS Index, an indicator of Germany's performance, as compared with other EU countries, in four areas of progress that are essential for the future: Technology, Environment, Social, State. Where do Germany's strengths and weaknesses lie? What adjustments should the traffic-light government be making?

Key results:

- ▶ **Sweden** leads the overall ranking by a considerable margin, followed by Finland and the Netherlands.
- ▶ **Germany** is in the upper mid-section overall (sixth place out of 27 EU Member States) but lags significantly behind the top countries:
 - Germany's best result (fifth place) is in the "Technology" sub-index, primarily due to high research spending and a good rating in transport infrastructure.
 - The worst sub-ranking (eleventh place) is in the "Environment" sub-index, mainly because it only has mediocre scores for the level of renewables as a proportion of energy consumption and for pollutant emissions.
- ▶ **Some other highly populated EU Member States** are even further down the overall ranking:
 - France is in ninth place in the overall ranking and has some catching up to do especially in the "Social" and "State" columns.
 - Italy finds itself in 16th place in the overall ranking and its weakest areas are also in "Social" and "State" sub-indexes.

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1 Motive and idea

An awareness of the urgent need for social progress is at the heart of the agenda of Germany's new traffic-light government. The slogan "Dare to take progress further" provides a frame of reference for the entire coalition agreement which is considered to be a comprehensive modernisation of Germany in all policy areas. Such a task will require not only staying power but also an honest evaluation of where we are now: Where does the Federal Republic of Germany currently stand, compared to the other EU Member States, in areas that are key for the future? What are the areas in which Germany can already claim to be very progressive? What are the weak points which require more attention from the traffic-light coalition? Such an appraisal clearly cannot be limited to a consideration of individual indicators of success. A more comprehensive data-based approach is necessary in order to gain a more tangible insight into all the many facets of the different areas in which progress can be made.

This is where our concept of a progress index comes in: various forms of a society's progress are recorded and summarized in a multi-level index of countries. In the interests of transparency, the index will be purely based on country indicators derived from publicly accessible and recognised data sources. Official surveys will thus be used as far as possible. The focus will be on structural indicators relevant over the long term rather than cyclical variables. The index can thus be used to analyse a country's strengths and weaknesses in comparison with other EU countries and to identify untapped potential for modernisation of society. The four-column structure of the index is based on the current policy objectives of the EU. Thus the relative performance of EU Member States can be compared in individual fields of progress. Further development of the index going forward will provide an opportunity to accompany Germany and the other EU members on their path of structural change.

2 Methodical approach

2.1 Theoretical concept

Our approach to the design of the index is based on the sequence of steps outlined in the Handbook on Constructing Composite Indicators, a joint work of the OECD and the Joint Research Centre of the EU Commission¹.

The first step in the development of any index is the formulation of a theoretical framework as a basis for the selection and combination of indicators. A clear idea of the nature of the multidimensional phenomenon being measured is the prerequisite for being able to define relevant sub-areas and assess their significance. In our case, the first question is the underlying definition of "progress" in the context of the EU.

The progressiveness of societies has a long intellectual tradition as a theoretical concept. During the Enlightenment, general social progress became a guiding principle of the philosophy of history. The history of mankind seemed to be an inexorable quest for the optimum. Since then, countless natural and man-made disasters have shaken the idea of progress but have not succeeded in extinguishing it altogether. The idea of progress has instead adapted to the changing times and living conditions. With the advent of the modern era, we see increasing differentiation². Social progress becomes a

¹ Joint Research Centre-European Commission. (2008). Handbook on constructing composite indicators: methodology and user guide. OECD publishing.

² Speich Cassé (2012). Fortschritt und Entwicklung. Docupedia-Zeitgeschichte, 21.09.2012.

multidimensional concept in which development sometimes pulls in different directions making it difficult to classify societies using a simple linear scale. This means that no generally accepted definition of social progress has so far become established. In view of current challenges, however, progress in the sense of shortening the distance to the socially ideal would nevertheless seem to be essential. Without the benchmark at least of a rough definition of the optimum, it is impossible to evaluate the success of efforts towards societal transformation relating to climate change, digitalisation, etc. A practicable definition should be based on the specific object of investigation and the problems identified by society in this regard.

Our conceptualisation of social progress in the EU area is therefore connected to the fields of action currently identified as priorities by the European Union. As a basis for its current work programme, the European Commission has identified the following six priorities³:

- A European Green Deal,
- A Europe fit for the digital age,
- An economy that works for people,
- A stronger Europe in the world,
- Promoting our European way of life,
- A new push for European democracy.

While the priority of "A stronger Europe in the world" concerns the common foreign and trade policy and does not therefore lend itself to a comparison between EU member states, the other five priorities are aimed at areas of society in which structural differences within the EU area are evident. At the same time, varying concepts of progress are apparent. The "European Green Deal" sees Europe's transformation into a climate-friendly and sustainable economy as a process of modernisation and primarily pursues an environmental concept of progress. With "A Europe for the digital age", the Commission plans to develop a digital strategy to shape Europe's path towards digitalisation; in addition to environmental and ethical aspects, this primarily involves progress in the technological sense. With "An economy that works for people", on the other hand, the focus is primarily on individual employment prospects and issues around sharing in economic prosperity. "Promoting our European way of life" in turn looks at safeguarding fundamental European values and ensuring their realisation in law and society, primarily by strengthening the existing European political and legal institutions. Finally, "A new push for European democracy" forges a link between issues of social participation and political institutions with the aim of expanding co-determination and transparency in the political decision-making process.

In order to use this set of targets as a basis for designing the index, the wide variety of individual targets first have to be distilled into clearly defined domains which, as the next step, can be operationalised by means of measurable indicators. We propose a separation into a total of four such domains, which are generally coherent in themselves and which altogether generally cover the overall scope of action of the five aforementioned EU priorities: **Technology, Environment, Social, State**. The domains are each represented by columns/sub-indexes within the overall index (**TESS Index**), and can be evaluated both independently and as part of the overall assessment. In addition to their function as independent targets for progress, all four domains are also likely to play an important role in securing long-term prosperity. Thus, it also makes sense to compare our concept of progress with indicators of income

³ [The European Commission's priorities](#)

development. In order to highlight the relevance of individual columns and embellish them with concrete indicators, the underlying problem areas must be defined in more detail. To this end, we have formulated specific key questions - which also correlate with the objectives pursued by the Commission. Table 1 summarises the economic relevance and related key questions applicable to the columns.

Tab. 1: The four index domains - key questions and economic relevance

Domain	Economic relevance	Key questions
Technology	The availability and use of the latest technology in production, administration and transport is essential for ensuring competitiveness and prosperity in Europe.	What relevance does investment in research have for the use of resources? How widespread is the use of digital technology? How up to date is infrastructure?
Environment	Against the backdrop of the global climate crisis, the switch to an ecologically sustainable economic model is not only essential from an environmental perspective, but is also a prerequisite for participation in the value chains of the future.	How emission-intensive is economic activity currently? How sustainable is the energy supply? How far is the country in implementing a circular economy?
Social	Equality of opportunity, social inclusion and (related to this) social harmony are prerequisites for exploiting the productive capabilities of the individual	Are the basic conditions in place for broad-based participation in society? What is the level of equal opportunities, especially with regard to women and young people? How strong is social cohesion?
State	Effective and transparent state institutions, which at the same time allow private actors an extensive degree of freedom for individual development, are a prerequisite for the spread of ideas, free enterprise and initiative	How effective is regulation in terms of providing economic incentives? How transparent and participatory is political and administrative action? To what extent is private-sector action restricted by regulation?

Source: Own design

2.2 Research indexes and databases

In order to translate the key questions into concrete indicators, the next step was to find existing country indexes with a similar objective. We initially considered indexes with a clear connection to the concept of progress. The search was then extended to include indexes focusing on any one of the four domains that we had established. Finally, indexes focussing primarily on the attractiveness and competitiveness of countries were also examined more closely, as these can also be based in part on indicators that are relevant for the concept of progress. Table 2 compares the similarities and differences between the indexes found. The vast majority of them are limited to one or just a few progress areas. The index closest to our own concept is the Social Progress Index from the Social Progress Imperative. However, it has a global horizon and a clear focus on developing and emerging countries. The Social Progress Index therefore contains many indicators that are only relevant for assessing the progress of countries at a low level of development. In contrast, by deliberately restricting our index to the EU, we can draw specifically on those indicators that are suitable for mapping intra-European structural differences. The characteristics included in the existing indexes were used in the pre-selection of indicators for our index (see section 2.3).

Tab. 2: Overview of existing indexes

Index name	Institution	Domains referenced	Number of columns/sub-indexes	Number of indicators	Number of countries considered
Best Countries	U.S. News & World Report	Social, State	9	65	73
Digital Economy and Society Index (DESI)	European Commission	Social, Technology	4	33	27
Environmental Performance Index (EPI)	Yale Centre for Environmental Law & Policy	Environment	11	32	180
Global Cleantech Innovation Index	WWF / Cleantech Group	Technology, Environment	4	15	40
Global Competitiveness Index	World Economic Forum	Social, State, Technology	12	114	137
Global Innovation Index	WIPO	State, Technology	2	81	132
Global Sustainable Competitiveness Index	SolAbility	Social, State, Technology, Environment	5	130	180
Human Development Index	United Nations	Social	3	4	189
Legatum Prosperity Index	Legatum Institute	Social, State, Environment	12	300	167
Readiness for Frontier Technologies Index	UNCTAD	State, Technology	5	9	158
RobecoSAM Country Sustainability Ranking	ROBECO	Social, State, Environment	3	40	150
Social Progress Index	Social Progress Imperative	Social, State, Technology, Environment	3	53	168
Sustainable Society Index (SSI)	TH Köln	Social, State, Environment	3	21	154
Transition Performance Index	EU Commission	Social, State, Environment	4	28	72

Source: Own design

In addition, the databases of various international institutions were consulted for the pre-selection of indicators. We initially focussed on Eurostat, the statistical office of the European Union, as the leading institution for the dissemination of the national official data of EU Member States. We also examined the databases of global institutions for progress-related indicators to take account of the subject areas not covered by official surveys. These include the World Development Indicators and Worldwide Governance Indicators of the World Bank, the database of the United Nations Conference on Trade and Development (UNCTAD) as well as the subject-specific surveys of various private and governmental organisations (Heritage Foundation, CSIRO, Inter-Parliamentary Union).

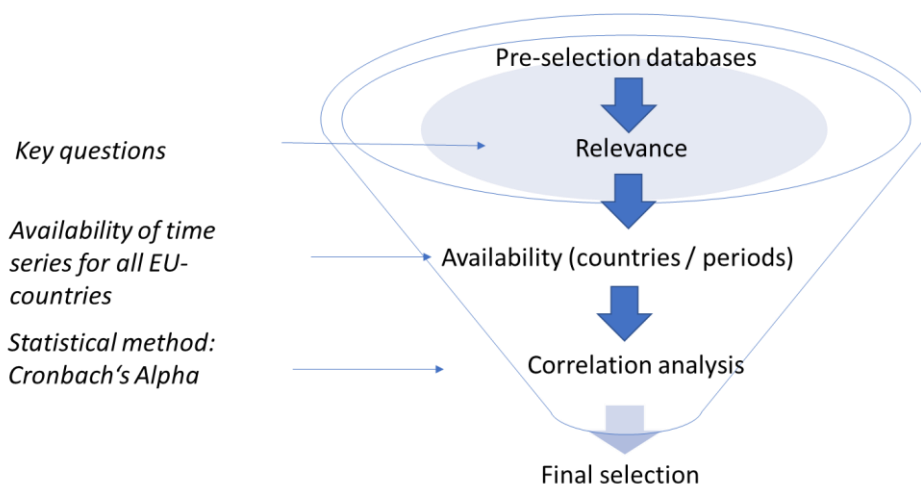
2.3 Indicator selection process

The indicators pre-selected during searches of indexes and databases were subjected to a multi-stage filtering process. First, we carried out filtering based on content. The key questions that we had formulated (see section 2.1) served as a basis for assessing the relevance of individual indicators in terms of content. In this regard, a clear link to only one key question was not an absolute requirement. The indicators thus selected were then examined in more detail with regard to the structure of the available data points. Firstly, in this regard, it was crucial that the values were basically available for each of the 27 EU Member States. In addition, the ability to observe changes over time had to be provided. This requires indicator values to be collected regularly and using a comparable methodology. Thus, index values can be regularly updated in the future and there is also a larger number of

observations for the statistical investigation of correlations between the selected indicators, which is also important for our method of weighting indicators (see section 2.4). On that basis, indicators resulting from special surveys or other (so far) one-off surveys were excluded from further consideration. The remaining indicators were then distributed, based on content, between the four columns of our index concept.

As a final step in the selection process, we examined the internal consistency of the selected indicator sets. The first question here was how far the content of individual indicators could be considered redundant and therefore excluded. Another selection question was whether any indicator measures fundamentally different concepts of progress to the other indicators in the same column. A clear answer to this question can only be given on a theoretical basis. Nevertheless, an analysis of the data structure in such cases does at least provide hints. Specifically, the bivariate correlation of the indicators within a column was examined and a very strong positive correlation was taken to be an indication of redundancy. To answer the second question, we used Cronbach's alpha, which is a coefficient widely used for these purposes⁴. This coefficient can be used to determine the extent to which the exclusion of individual indicators from a set of indicators will strengthen or weaken the correlation of the variables within a set. Omitting indicators whose pattern shows hardly any connection to the other indicators strengthens the internal consistency of the column under consideration. The recommendations in the OECD Handbook were followed as a guideline. This concluded the selection of indicators. Figure 1 summarises the stages of the selection process.

Fig. 1: Filter process used for indicator selection



Quelle: Own design

2.4 Weighting and aggregation

In order to derive an index number from the set of selected indicators, a methodology must be applied to aggregate the indicators and determine the weight of individual indicators within the aggregate. In our case, with a two-tier index, this determination takes place on two levels simultaneously, namely as between the columns and within the columns. Within the columns, it was necessary to clarify how the indicators represented therein could be meaningfully combined into one representative measure for the relevant domain of progress. Many of the existing indexes (see section 2.2) use the simplest

⁴ Bland, J. M., & Altman, D. G. (1997). Statistics notes: Cronbach's alpha. *Bmj*, 314(7080), 572.

possible approach in this respect: Following a normalisation process, the index value is calculated as a simple average of the normalised indicators. Such an approach, although intuitive, is usually not very information-efficient, as it ignores information from patterns observed in the data. This is because, even if all the indicators chosen are basically relevant, they may still differ in their level of proximity to the concept expressed by the index. In our case, this means that the measured values of the indicators will differ in how closely they reflect the domain of progress represented by the respective column. Ideally, therefore, it is precisely this level of proximity that should provide the basis for the weighting.

Since it is virtually impossible to quantify weightings on a theoretical basis, an analysis of the empirically observed correlation patterns is also required. For this purpose, we resorted to the frequently used methodology of factor analysis. This allows the factors that lie behind the observable data to be identified and thus a large number of measurable indicators can be reduced to a few underlying (non-observable) variables. Specifically, using a method developed by Nicoletti et al. (2020) and recommended by the OECD, the weightings were derived from the factor loadings of the indicators and from the variance explained by the respective factor.⁵ Based on these weightings, column values were then calculated as a weighted average of the indicators included. These were finally standardised on a scale of 0-100 using the MinMax method⁶. The values thus included in the index were based on the most recent data points available in the respective source for each indicator.

The sub-indexes obtained in this way were then combined to form an overall index. Since the sub-indexes represent fundamentally different domains of progress, a different weighting could only be justified on a normative basis. And as considerations in this regard are subjects more suited to a discussion of social issues, we have refrained from this approach and given the domains equal weighting in the overall index. At the same time, in the presentation of the results, we always show the results of the sub-indexes on an equal footing with the overall index which makes it easy to deduce the individual weightings. With regard to the form of aggregation, the choice is between arithmetic and geometric averaging, with substantive consequences for the substitutability of the individual domains in the overall assessment. We tested both aggregation methods and the resulting country rankings showed only minimal differences. In order to simplify interpretation, we therefore used the arithmetic average. The calculation steps carried out in the context of weighting and aggregation were implemented in the statistical software STATA.

3 Structure of the TESS Index

3.1 Overall index

The structure of the TESS index is illustrated in Figure 2. The overall measure of an EU country's progressiveness is shown as the average of four columns (technology, environment, social, state), each representing specific domains of progress. The subject areas covered by each column are also listed in Figure 2. Their relevance in terms of content is discussed in more detail in the following subsections.

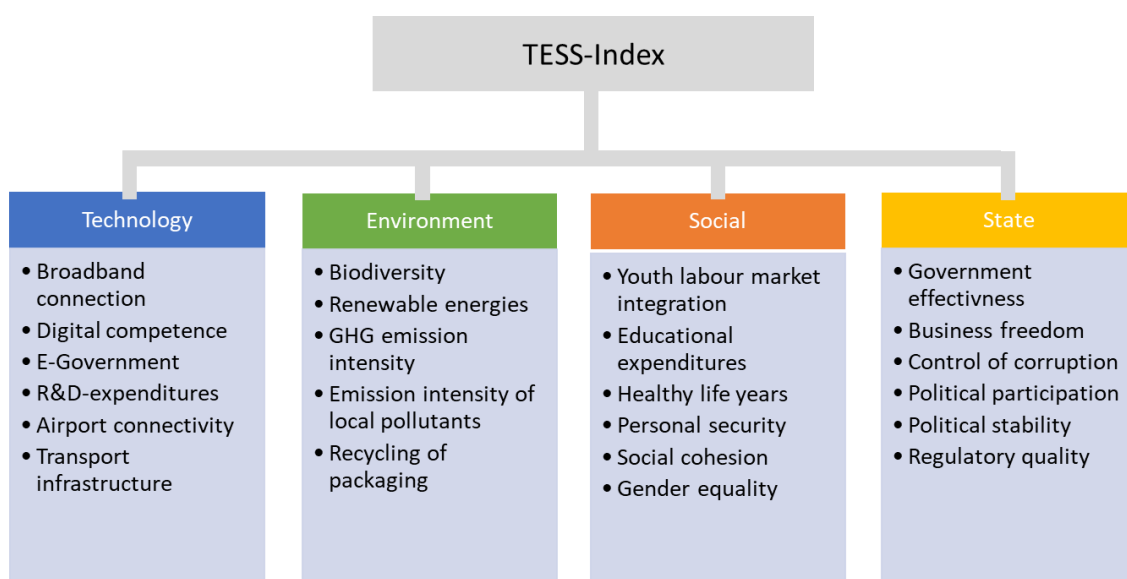
In order to interpret the index values correctly, it is first important to emphasise that the focus is on structural indicators rather than on cyclical and thus short-term, volatile variables. This implies that the link to (national and EU-wide) policy instruments tends to be indirect in nature. Although all

⁵ Nicoletti G., Scarpetta S. & Boylaud O. (2000). Summary indicators of product market regulation with an extension to employment protection legislation, OECD, Economics department working papers No. 226, ECO/WKP (99)18.

⁶ Calculation formula: Normalised value = (Value - Min.) / (Max.-Min.) * 100

indicators are ultimately subject to the effect of political action, this influence cannot be clearly linked to specific measures or instruments on the basis of the concept used. The index values should not therefore be read as indicators of the success of current government action and its related objectives, but rather as the result of socio-political forces acting over the long term. Nor do they represent, in the literal sense of the concept of progress, a direct measure of the distance to a social optimum to be achieved in the future. Such an optimum is in many cases unquantifiable on an objective basis, and it can also change over time with social preferences. Instead, the index values are normalised in such a way that the point of comparison is located in the present: by setting the maximum value achieved in the respective column at 100, this acts as a benchmark for the other countries (see section 2.4).

Fig. 2: Structure of the TESS Index



Source: Own design

3.2 Column: Technology

The annual amount of research and development expenditure (R&D) provides a statistical measure of a country's efforts in researching new technologies. We have chosen to use a country's **R&D spending as a proportion of gross domestic product (GDP)** as an indicator of how the distribution of expenditure is prioritised. The market penetration of broadband internet connections is used as an indicator for the development status of digital technologies. Since there are significant distributional differences between businesses and private households in this area, both the **proportion of businesses with broadband connections** and the **proportion of households with broadband connections** are taken into account. In addition to the availability of digital technology, there is also the question of how efficiently it is used. The survey-based indicator **digital skills in the population** measures general user skills in dealing with digital products and services. Finally, the use of digital communication channels by public authorities is also relevant when it comes to exploiting the potential of these technologies and this is taken into account in our index by the inclusion of an **e-government development** indicator. Rather than measuring the development of transport infrastructure using purely quantitative indicators regarding the length of the road network etc., a survey-based indicator from the World Bank's Logistics Performance Index is used to determine the **quality of transport-related**

infrastructure as assessed by logistics professionals. This indicator refers to domestic infrastructure, not to the level of integration into global transport networks, which is also relevant from a progress perspective. In addition, the **airport connectivity** indicator provides a measurement of how far the country's airports are directly connected to global hubs.

3.3 Column: Environment

Greenhouse gas emissions are an important indicator of emission-producing activities and thus of a country's contribution to climate change. We look specifically at the level of annual **GHG emissions as a proportion of the country's GDP**. This indicator measures the emissions intensity of economic activity in a country which is the opposite of climate efficiency. It is therefore entered into the environment column as a negative figure. Local **air pollution in the form of nitrogen oxides (NO_x) and particulate matter (PM_{2.5})** are included in the index as additional forms of emissions. While the former group of pollutants, in addition to irritating human respiratory tracts, contributes directly to the eutrophication and acidification of ecosystems and thus damages nature, the latter group poses a health hazard to human lungs due to the small size of the particles. In both cases, the emission values are also measured as annual emissions in relation to GDP, thereby allowing a comparison of emission intensity. In order to focus on overall energy use, sustainability of the energy supply is measured by the **amount of renewable energy as a proportion of total energy consumption**. Recycling rates play an important role as an indicator of progress towards a circular economy because recycling is usually a more sustainable form of end use than landfill or incineration. We use the **recycling rate of packaging**, a waste group that is of particular importance both because of its rapidly increasing global volume and because of the specific recycling targets of the EU Commission. Another relevant factor in the context of environmental quality is the direct impact of land use on ecosystems, especially in view of EU sustainability strategies in the agriculture and forestry sector. While no direct country indicators are available for the intensity of land use itself, data on the extent of aggregate habitat loss for local fauna and flora are collected by various institutions. In this regard, we use the Biodiversity Habitat Index of the Australian agency CSIRO as a measure of the expected **loss of biodiversity in connection with land use changes**.

3.4 Column: Social

We consider health and personal security to be an essential basic prerequisite for broad-based participation in society. The average **number of healthy life years** provides an indicator which estimates the average length of time that people can participate in social life without health-related restrictions. The **homicide rate** can be used as a basic indicator of personal safety in the sense of protection against violent crime. It is thus entered as a negative value in the index. More broadly, access to adequate education is also an important prerequisite for participation in social life as well as for providing equal economic opportunities for the younger generation. We measure the focus of government activity in this regard based on **public spending on education as a share of GDP**. Since the level of expenditure alone has only limited informative value for the integrative effect of education, we additionally include the **proportion of young people (aged 25-34) not in employment, education or training** as a negative influence in the index. The **average gender pay gap** provides an indicator of equal opportunities for men and women. However, since this indicator only captures observed wages and not the impact of the gap on incentives to work, we supplement it with the **gender employment gap**. In order to also address gender-related equal opportunities in the socio-political domain, the

proportion of women among members of national parliaments is included as an additional indicator. Finally, social cohesion is taken into account using a survey-based index from the Legatum Institute on perceived **social cohesion**.

3.5 Column: State

In order to measure the effectiveness of state actors, we have used, on the one hand, an index from the World Bank on perceived **government effectiveness** and, on the other, an index of the perceived **quality of regulation**, defined here in terms of its suitability for promoting private economic activity, measuring the rationality and consistency of state regulation. An essential prerequisite for the reliability of political action is firstly the **stability of the political system**. For this, a survey-based indicator from the World Bank was used. The ability to influence political action is measured not only by electoral involvement but also by freedom of the media and public debate, as well as the accountability of political actors vis à vis public supervisory bodies. The **voice and accountability** indicator combines these aspects. An important signal for the transparency of administrative action is success in preventing/mitigating corruption in the public sector, expressed by way of an indicator on the perceived effectiveness of **corruption control**. Finally, individual freedom allowed by state regulation to pursue economic activities is measured by two indicators: **business freedom**, meaning the possibility of autonomous entrepreneurial activity without undue state intervention, and **labour freedom**, meaning the virtual absence of state restrictions on the arrangement of employment relationships.

4 Index results

4.1 Results in overall ranking

Table 3 presents the results of the overall index, calculated as a simple average of the sub-index values in the four index columns. In this respect, Sweden leads the EU Member States by a relatively large margin. The country comes top in three of the four sub-rankings. The other Scandinavian EU members, Finland and Denmark, are also in the top group in the overall ranking. Among the most highly populated countries, Germany (sixth) and France (ninth) are the furthest ahead in the overall assessment. Spain (13th) and Italy (16th), on the other hand, are only in the mid-section and Poland (20th) is actually in the lower section of the ranking. Greece, Bulgaria and Romania are quite clearly bringing up the rear with results that are consistently well below average in all sub-indexes. In general, a relatively clear geographical pattern is visible. Countries from the western and northern part of the EU area tend to be further up in the overall ranking, countries from the southern and eastern part of the EU further down. The best Eastern European member state, Estonia, lies in tenth place. It should be noted that this ranking is based on the normative premise that all four domains of progress are of equal importance. More information on the background to the countries' performance in the individual domains is provided in the sections below.

Tab. 3: Results of the index calculations

Country	Overall index		Sub-indexes (columns)							
	Score	Ranking	Technology		Environment		Social		State	
	Score	Ranking	Score	Ranking	Score	Ranking	Score	Ranking	Score	Ranking
Sweden	97.79	1	100.00	1	100.00	1	100.00	1	91.17	5
Finland	88.61	2	95.63	3	88.36	2	70.44	2	100.00	1
Netherlands	74.57	3	92.66	4	43.98	12	68.39	4	93.26	4
Denmark	72.34	4	98.53	2	23:11	22	70.38	3	97.36	3
Austria	68.84	5	75.28	6	69.68	3	53.60	9	76.81	8
Germany	67.50	6	87.48	5	45.85	11	57.89	7	78.77	7
Luxembourg	63.78	7	47.69	12	47.61	8	61.77	5	98.05	2
Belgium	61.96	8	74.67	7	48.89	5	59.08	6	65.19	10
France	54.38	9	63.15	8	48.76	7	50.67	11	54.96	11
Estonia	52.19	10	57.53	9	48.85	6	30.16	17	72.22	9
Ireland	50.74	11	33.75	15	47.43	9	42.55	14	79.25	6
Slovenia	50.05	12	48.35	11	49.47	4	54.98	8	47.41	16
Spain	46.96	13	55.65	10	42.29	15	51.76	10	38.14	18
Portugal	41.99	14	30.54	17	38.22	16	47.81	12	51.39	13
Czech Republic	40.38	15	39.94	14	41.45	18	29.62	18	50.52	14
Italy	36.32	16	44.64	13	43.62	13	29.46	19	27.55	22
Malta	35.30	17	24.20	19	22.42	23	44.49	13	50.09	15
Lithuania	34.03	18	27.81	18	40.32	17	13.68	23	54.32	12
Cyprus	33.07	19	32.69	16	34.24	20	30.17	16	35.18	19
Poland	26.25	20	22.62	20	17:43	26	36.35	15	28.59	21
Latvia	25.43	21	03:16	25	46.22	10	7.92	26	44.44	17
Slovakia	24.41	22	7.99	23	43.17	14	14.71	22	31.76	20
Croatia	19.92	23	6.86	24	34.79	19	21.74	21	16:27	25
Hungary	17.98	24	22:48	21	22:02	24	8.88	25	18:54	24
Greece	12:33	25	18:24	22	0.00	27	12:41	24	18.66	23
Bulgaria	12:26	26	0.75	26	21:23	25	27.07	20	0.00	27
Romania	9.75	27	0.00	27	33.80	21	0.00	27	05:18	26

Source: Own calculations

4.2 Results sub-indexes

Technology:

In the "Technology" domain of progress, the three Scandinavian EU members come out top. These countries are particularly strong when it comes to the use of digital technology. They are a long way ahead in a European comparison both as regards the level of digital literacy in their population and the prevalence of e-government. Just below them in the technology column are the Netherlands and Germany, two countries that perform well, particularly in terms of the quality of their infrastructure. In the case of Germany, this applies primarily to the quality of its transport infrastructure and global connectivity, and in the case of the Netherlands to its digital infrastructure. Germany, scores poorly here, however, when it comes to e-government and broadband access for private households. The rest of the field is a fair distance behind. France is in eighth place here. The country performs relatively well in the area of transport infrastructure but needs to catch up especially when it comes to the availability

of broadband connections as well as digital literacy. Of the Eastern European countries, Estonia does best here, taking ninth place, primarily due to its marked digital expertise. Italy ranks 13th, with weaknesses in digital literacy and e-government. Ireland only ranks 15th in this column despite the presence of numerous global digital corporations in the country. Latvia, Bulgaria and Romania are a long way behind at the bottom of the sub-ranking, primarily due to a combination of low research spending and poor transport infrastructure.

Environment column:

Sweden and Finland are firmly placed at the top in the "environment" column. In addition to the high levels of renewable energy as a proportion of energy consumption and a low emissions intensity as regards greenhouse gases, this is also due to a good score for biodiversity. In terms of index points, Austria is well below them but in third place, mainly due to generally low emission levels compared to the level of economic activity. A broad mid-section of countries follows behind, once again at a significant distance. The best Eastern European country in this category is again Estonia, in sixth place. France is in the upper mid-section here (eighth place), mainly due to low greenhouse gas and pollutant emissions in relation to economic output. Somewhat further behind is Germany (11th place), with only mediocre values for pollutant emissions and its level of renewable energies as a proportion of final energy consumption. Compared with the other columns, Denmark is well down the list here, primarily as a result of the very high nitrogen oxide and particulate matter emissions in relation to economic output. Poland also scores well below average in this category, mainly due to a low level of renewable energies and generally high emission levels. Greece clearly comes last in this column due to poor values across all indicators, especially in the area of nitrogen oxide and particulate matter emissions.

Social column:

The Scandinavian EU Member States come out as the top three in the "social" domain, this time with Sweden very much in the lead. The country is leading particularly in education and health, but also in the proportion of women in parliament. In general, the Scandinavian countries score very well on social cohesion. They are followed in the sub-ranking by the three Benelux countries. While the Netherlands principally gained points due to a high level of social cohesion and good labour market integration among young people, Belgium's good ranking was mainly down to high education expenditure and Luxembourg's to the low gender pay gap. Germany takes seventh place in this sub-ranking: Relatively good results for youth unemployment and social cohesion contrast with a gender pay gap that is above the EU average, as well as rather low spending on education. The best Eastern European country in this sub-index is Slovenia in eighth place, partly due to low wage differentials between men and women. France is in eleventh place here; the country scores most points for education spending but fewer for social cohesion. Otherwise, within the group of highly populated countries, Italy's rather poor performance (19th place) is particularly striking. The main reasons for this are the significant difference in labour force participation between men and women as well as a high proportion of young people not in employment or education. Hungary, Latvia and Romania are at the bottom of this sub-ranking. In the case of Latvia, this is mainly due to the low number of healthy life years and the high gender pay gap. Romania scores very poorly here on almost all indicators.

State column:

The "State" column is led by Finland, closely followed by Luxembourg and Denmark. The other countries in the top 5 (Netherlands, Sweden) are close behind. Finland achieves particularly high scores in government effectiveness, quality of regulation and political participation. Luxembourg is rated best in terms of political stability and entrepreneurial freedom. Denmark is ahead in the area of corruption control. Germany ranks seventh in this category, with good rather than very good scores for most of the indicators included. The best Eastern European country is Estonia in ninth place. France is ranked eleventh here, with comparatively weak scores in political stability as well as in entrepreneurial freedom. Looking at the other highly populated countries, it is noticeable that Spain (18th place) and Italy (22nd place) have their worst ranking in this category compared to the other columns. To some extent, this is due to the quality of regulation, which is classed as below average, but also, for example, to a relatively low level of entrepreneurial freedom. In the case of Italy, government effectiveness is also rated as relatively low. At the bottom of the scale here are Croatia, Romania and Bulgaria. In the case of Croatia, the quality of regulation and political participation are rated as particularly poor. Romania and Bulgaria come last in almost all the indicators in this sub-index.

4.3 The TESS index and per capita income

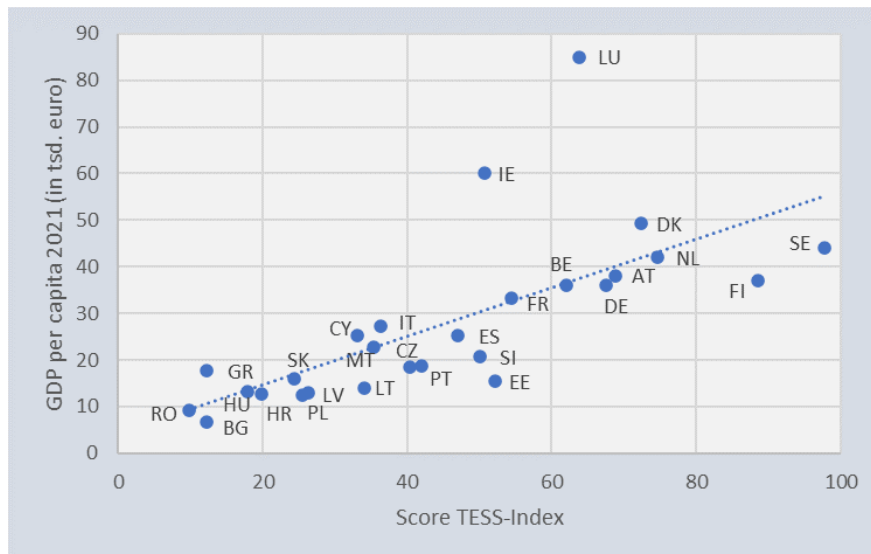
Given the economic relevance of the country indicators used and our concept of progress in general, an assessment of the results in terms of the economic strength of the EU Member States is the obvious course of action. Figure 3 compares the country values in our overall index to the countries' per capita GDP in 2021. There is a relatively close positive correlation.⁷ From a theoretical perspective, this is, in principle, hardly surprising. The level of social progress, if it represents a tangible value, should also correspond with economic prosperity to a certain degree, whether because progress in some areas is the condition for economic growth, or because a society's purchasing power makes the realisation of certain forms of progress possible or because progress and prosperity are interdependent. However, the exceptional cases among the countries make it clear that our index is more than just an indicator of economic strength. Thus, the outstanding position of Luxembourg (LU) and Ireland (IE) in terms of per capita income is not reflected in our index results: The two countries are only in the upper mid-section in the overall index. This is consistent with the fact that these countries owe their high level of domestic product in part to their status as the headquarters of many multinational corporations; in some cases, revenue streams are recorded domestically simply for tax reasons. These misleading accounting effects play no relevant role for the indicators included in our index. Conversely, there are also examples of countries where, purely based on economic strength, we would not have expected such a good performance in the index. This includes Estonia (EE), which leaves richer countries such as Spain (ES) and Italy (IT) behind in the overall index. Finland (FI) too, which comes second, is well ahead of Germany (DE) and France (FR) which have comparable income levels. Thus, our index also contributes to the long-standing debate on whether macroeconomic measures of income have any value as indicators of prosperity.⁸ Going forward, a time series analysis of how the TESS Index develops in relation to long-term GDP growth or of the trends in other macroeconomic variables, would be interesting. Thus, one could investigate the extent to which the method of measuring progress which

⁷ The corresponding correlation coefficient is 0.698.

⁸ See for example: Fleurbaey, M., & Blanchet, D. (2013). *Beyond GDP: Measuring welfare and assessing sustainability*. Oxford University Press.

we have constructed is also suitable for predicting economic processes or, conversely, is in fact subject to them.

Fig. 3: Comparison of TESS index values and the countries' per capita GDP



Source: Eurostat (2022); Own calculations.

5 Conclusion

Sweden leads the TESS-index's overall ranking by a considerable margin, with the other Scandinavian EU members Finland (second place) and Denmark (fourth place) also occupying top positions. In third is the Netherlands. Germany can be found in the upper mid-section (sixth place) of the overall ranking, but a significant distance behind the leaders. The four columns depicted in the index have varying degrees of influence on this. Germany managed to achieve its best result (fifth place) in the "Technology" sub-index, primarily due to high research spending and a good rating in transport infrastructure. Germany has most catching up to do in the environmental sector (eleventh place), primarily as a consequence of only mediocre values compared to other European countries for the level of renewables as a proportion of total energy consumption and for pollutant emissions. In this respect, the traffic light government can consider itself vindicated in making climate change the main focus of its agenda.

From a European perspective, the index values clearly show a gap between eastern and western, and especially between northern and southern member countries. At the same time, there are surprises in the detail. Thus, a country like Estonia is able to hold its own in the overall ranking against traditional economic powers like Spain and Italy. Overall, the poor performance of western European countries in individual sub-indexes brings into sharper focus the areas in which specific countries have some catching up to do. The role of per capita income as a measure of economic prosperity is also clearly positive, but not perfect, as is shown for example by the fact that countries such as Ireland and Luxembourg only achieved mediocre results. Thus, as a supplement to established macroeconomic indicators, the TESS index represents a promising new measure of the structural differences that exist in the EU area. It provides material for further detailed analysis and - via regular updating - will also provide a basis for assessing the future success of Germany and the other EU member states in coping with forthcoming structural change.

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