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Michaela Saisana and Giuseppe Munda

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**Extended Executive Summary**

In the Knowledge-based Economy conceptual framework that was developed by MERIT a total of 115 individual indicators have been selected to measure the sub-dimensions of the KBE. The number of indicators per sub-dimensions varies between 1 and 12. The high number of individual indicators raises the issue of robustness of the ranking obtained by their aggregation into one composite measure. To tackle this issue a sensitivity analysis is a fundamental step of the KEI composite indicator. In particular, in building the KEI composite an innovative methodological assumption has been made, i.e. it is considered as the final composite index the frequency of all rankings obtained by means of all the simulations carried out. This allows us to deal with the criticism, often made to composite indicators that rankings are presented as they were under conditions of certainty while it is well known that this is not true in general terms. Most practitioners compute a composite indicator by a simple weighted summation mathematical model. Sometimes it is acknowledged that the ranking obtained is subject to some uncertainty, but this issue is treated as a kind of mathematical appendix for technical readers, and all policy suggestions are derived under the assumption of the linear aggregation model. Here the ranking presented is the one derived by considering the whole spectrum of uncertainty. It is important to note that this is a peculiar characteristic of the KEI composite.

The scenarios, simulations and indicators developed by the JRC team answer five main research questions:

1. Is it possible to measure the knowledge economy?
2. What are the drivers of the knowledge economy?
3. How does knowledge economy relate to other complex dimensions?
4. Is it possible to reduce the total number of individual indicators of KEI conceptual framework without loosing any relevant information?
5. Are rankings useful at all for deriving policy suggestions?

1) A multi-modelling approach was applied to weight and further aggregate the sub-dimensions scores into dimensions and finally into a composite indicator. The approach consisted of about ***2,000 simulations*** (saturated sampling) based on combinations of the:
- imputation method (dataset deriving from either splines or multiple imputation),
- number of sub-dimensions (all 29 sub-dimensions included or one-at-time excluded)
- number of dimensions (all seven dimensions included or one-at-time excluded)
- normalisation of the 29 sub-dimensions scores (z-scores or min-max),
- structure relating the sub-dimensions to the dimensions (preserved or not),
- weighting method (factor analysis, equal weighting, data envelopment analysis),
- aggregation rule (additive, multiplicative, non-compensatory multi-criteria analysis).

Although, this analysis may look very technical in nature, in reality a social component is also present. In fact to consider or not a given dimension, normally has behind a long story of social, political and scientific controversy. Thus to include or exclude a given dimension or a set of indicators means to deal or not with peculiar social concerns and social actors. The ***frequency matrix*** of a country's rank in each of the seven dimensions and the overall KEI

was calculated across the ~2,000 scenarios. Besides the frequency matrix, the median rank per country was selected for further analysis of the associations between KEI and its main dimensions, or other complex concepts, such as human development.
The KEI composite indicator results are the following:

**Knowledge Economy Index**

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sweden | 54 | 46 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Denmark | | | 55 | 30 | 14 | | | | | | | | | | | | | | | | | | | | | | | | |
| Luxembourg | 36 | 4 | 14 | 25 | 4 | 7 | 7 | 4 | | | | | | | | | | | | | | | | | | | | | |
| Finland | | 18 | 23 | 29 | 9 | 11 | 11 | | | | | | | | | | | | | | | | | | | | | | |
| USA | 11 | 32 | 2 | 4 | 39 | 9 | 4 | | | | | | | | | | | | | | | | | | | | | | |
| Japan | | | 4 | 7 | 18 | 32 | 36 | | | 4 | | | | | | | | | | | | | | | | | | | |
| UK | | | 2 | 5 | 16 | 38 | 39 | | | | | | | | | | | | | | | | | | | | | | |
| Netherlands | | | | | | | | 86 | 4 | | 4 | | | 7 | | | | | | | | | | | | | | | |
| Ireland | | | | | | | 4 | | 61 | 14 | 4 | 9 | 9 | | | | | | | | | | | | | | | | |
| Austria | | | | | | | | | 18 | 50 | 18 | 7 | | 7 | | | | | | | | | | | | | | | |
| Belgium | | | | | | | | 11 | 4 | 11 | 57 | 16 | 2 | | | | | | | | | | | | | | | | |
| France | | | | | | 4 | | | 14 | 18 | 11 | 54 | | | | | | | | | | | | | | | | | |
| EU15 | | | | | | | | | | | 4 | | 57 | 39 | | | | | | | | | | | | | | | |
| EU25 | | | | | | | | | | 4 | 4 | 14 | 32 | 39 | 7 | | | | | | | | | | | | | | |
| Germany | | | | | | | | | | | | | | 7 | 79 | 4 | 7 | 4 | | | | | | | | | | | |
| Slovenia | | | | | | | | | | | | | | | 7 | 41 | 38 | 14 | | | | | | | | | | | |
| Estonia | | | | | | | | | | | | | | | | 4 | 36 | 25 | 21 | 11 | 4 | | | | | | | | |
| Malta | | | | | | | | | | | | | | | 7 | 13 | 9 | 21 | 23 | 27 | | | | | | | | | |
| Cyprus | | | | | | | | | | | | | | | | 36 | 7 | 4 | 23 | 23 | 7 | | | | | | | | |
| Spain | | | | | | | | | | | | | | | | 4 | 4 | 32 | 25 | 29 | 7 | | | | | | | | |
| Czech. Rep. | | | | | | | | | | | | | | | | | | | 4 | 7 | 30 | 39 | 5 | 7 | 7 | | | | |
| Latvia | | | | | | | | | | | | | | | | | | | | | 20 | 36 | 11 | 21 | 7 | | 5 | | |
| Italy | | | | | | | | | | | | | | | | | | | | | 29 | 18 | 9 | 29 | 9 | 7 | | | |
| Greece | | | | | | | | | | | | | | | | | | | | 4 | 4 | 4 | 29 | 18 | 21 | 7 | 14 | | |
| Lithuania | | | | | | | | | | | | | | | | | | | | | | 4 | 41 | 13 | 32 | 11 | | | |
| Hungary | | | | | | | | | | | | | | | | | | | | | | | 2 | 13 | 13 | 57 | 2 | 14 | |
| Portugal | | | | | | | | | | | | | | | | | | | 4 | | | | 4 | | 7 | 11 | 61 | 14 | |
| Slovakia | | | | | | | | | | | | | | | | | | | | | | | | | 4 | 7 | 18 | 71 | |
| Poland | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 100 |

*Legend:*
Frequency lower 15%
Frequency between 15 and 30%
Frequency between 30 and 50%
Frequency greater than 50%

This is a novel approach to the presentation of results of a composite indicator. Our objective here is to synthesize and make explicit the uncertainty contained in the country ranking. For each country it is indicated the percentage of times it was in a given rank in all the 2,000 simulations, one can see that e.g. Poland was 100% of times in the last position, and Sweden 54% of times in the first position and 46% in the second.

A first consideration is that the overall ranking is very stable; in fact considering the whole 2,000 simulations, all countries are clustered unambiguously. No doubt the top performing countries are Sweden, Denmark Luxembourg, Finland and the USA. Then it follows the group Japan, United Kingdom, Netherlands and Ireland (where Japan and UK are slightly better than the other two). Austria, Belgium, France and Germany form the next group (where Germany is slightly worst than all the other three). All the rest of countries can be considered with a bad performance with respect to a knowledge based economy. However, we could still split this class into two subsets: a first one including Slovenia, Estonia, Malta, Cyprus, Spain, the Czech Republic, Latvia, Italy, Greece and Lithuania is a bit better than the worst performing group including Hungary, Portugal, Slovakia and Poland. An interesting result is also that overall both USA and Japan have a better performance than EU 15 and EU 25.

To better understand the influence of the conceptual model used to derive these results, we have computed country rankings by using the subset of individual indicators belonging to

each one of the seven dimensions, thus other seven rankings have been obtained. The objective of this analysis is to check if in some single dimensions, poor performing countries might present an improvement or vice versa, good performance countries a worsening. Of course rankings are obtained again by considering the whole spectrum of uncertainty related to the computations.

Overall, dimensions A1(Production and diffusion of ICT), A2 (Human resources, skills and creativity) and A3 (knowledge production and diffusion) supply rankings correlated with the KEI composite indicator highly. In these three dimensions Finland is always the top country, but Sweden is always very close to it. In the bottom of the ranking we can find both Cyprus and Portugal, but Poland is never too far from the last position. On dimension A1 Italy has a net improvement but it is still far from the top performing countries. The grouping of countries is very similar to the one of the KEI composite (with all the seven dimensions). On the contrary, A4, B1, B2 and C1 produce country rankings with bigger differences. On dimension A4 (Innovation, entrepreneurship and creative destruction), Italy ranks as the bottom country with a very high degree of credibility (frequency= 11% rank 27, 32% rank 28 and 57% rank 29). Also countries like The Netherlands, Belgium, Austria and Germany show a very poor performance. Finland is closer to medium performance countries than to top countries. Spain improves its rank position considerably. Sweden is still a top performing country. Poland improves its performance surely, but it is very volatile (it occupies positions in the range from the 7-th to the 24-th and the frequency it is never higher than 14% in any position).

Taking into account dimension B1 (Economic outputs) only, big surprises exist. Although the bottom countries are very similar to the ones supplied by other dimensions, Greece (5-th position) and Spain (4-th position) are extremely well performing. Cyprus is also improving considerably. Denmark, Finland and Sweden are instead much worse, since they perform as medium countries. The same argument applies to dimension C1 (Internationalisation). The bottom countries are quite robust a part from Cyprus which is performing around the 7-th and 8-th positions. Portugal is in a better position than Finland (which is very volatile but never above the 17-th rank). Denmark and Sweden are between positions 11 and 13. Top performing countries are Luxembourg, Belgium, Austria and the USA. On dimension B2 (Social performance), top countries are Denmark, Sweden, Austria and the Netherlands. Particularly strong is the worsening of Finland which is around the 13-th position. Germany is also performing very badly (frequencies are clustered around positions 22 and 23). Improvements are shown by Hungary, Italy, Portugal and Spain which perform as middle ranked countries.

2) The internal consistency of KEI conceptual framework is synthesised by computing the relationship between the KEI overall ranking and the dimensions and sub-dimensions considered through the Spearman rank correlation coefficients. As a rough first conclusion we could state that overall all dimensions play a role but surely the less influential seems to be the innovation, entrepreneurship and creative destruction dimension. This conclusion is corroborated by a more sophisticated tool i.e. Path Analysis. By using path analysis, the influence of each single dimension on the total ranking can be computed (this influence is divided into a direct effect and an indirect one). Results of the path analysis conclude that all dimensions seem to have a more or less equal impact (the range is between 12 and 18) on the KEI ranking (please note that here only the linear aggregation is used, since path analysis cannot be carried out for the non-compensatory aggregation rule) except dimension A4 (Innovation, entrepreneurship and creative destruction, whose score is 8). The variability is much higher if one looks at the sub-dimension levels (e.g. very lows scores can be found for knowledge flows (7) or organizational indicators (2)). We can expect an even higher

variability at the individual indicator level; this is potentially very relevant if one desires reducing the set of indicators of the KEI conceptual framework. The rankings derived by a linear aggregation rule and a non-compensatory one (under the equal weighting within dimension assumption) are highly correlated, although the non-compensatory one appears more stable. Compensability might be an issue for Finland whose position in the non-compensatory ranking is definitely worse than the ones of Sweden, Denmark, Luxembourg, United Kingdom and Japan. The bottom countries are very stable in both rankings. Useful information is also coming from the comparison between the KEI median ranking and the ranking derived by using data envelopment analysis weights. Since these weights are beneficial for the bottom countries, we can state quite safely that even with endogenous weights the bottom countries are no doubt very stable, thus they are very far from being knowledge based economy countries. Regarding the top countries, it is noteworthy the strong top position of Sweden and the fact that Finland, even with its best set of weights, is still worse than Luxembourg, Japan and Denmark. A final observation is about Ireland. This country belongs to the set of more or less good performance countries, but it is never a real top countries, even with its best set of weights, we could thus conclude that according to the KEI conceptual framework and its statistical elaboration, the common perception that Finland and Ireland are the most relevant success stories of knowledge based economies is somewhat misleading.

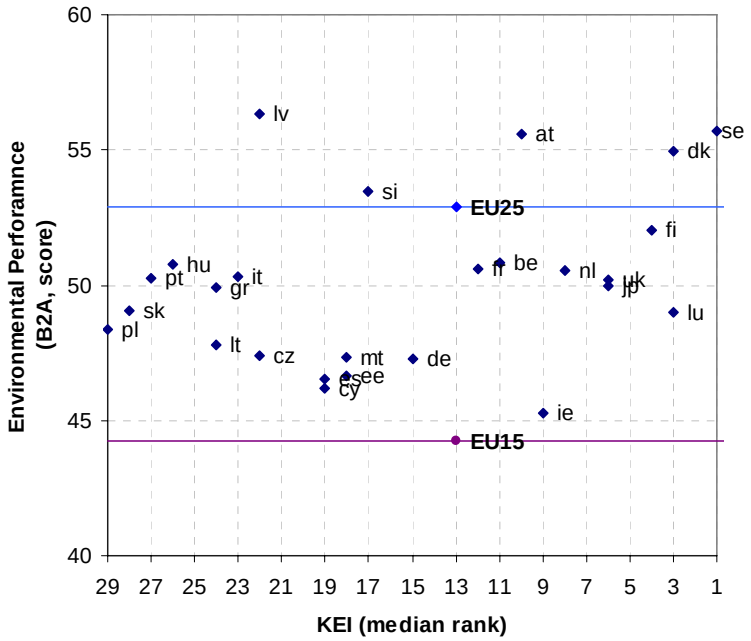
3) Economic theory tries to take technological change into account by two main theories: *Human capital theory* (whose main foundational principal is the recognition of the role of education and importance of skills people has) and *endogenous growth* (whose main idea is the Schumpeterian concept of accumulation of knowledge due to research and innovation in leading private firms).
First of all, let us try to understand if to be a knowledge based economy is relevant at all for a good overall economic performance. By looking at the relationship between GDP and the KEI median ranking the answer is YES. Except Germany, Italy and Spain which have a high level of GDP per capita without any particular good performance on a KBE, all the other high level GDP countries seem to perform well in the KEI composite (where Luxembourg can be considered an extreme case -probably an outlier-).

As we already know at the level of dimensions considered in the KEI framework, they all seem to have an influence on the knowledge based economies, thus both economic theories seem to have an influence (since roughly both theoretical models are conceptualized). However, a first result was that the Innovation, entrepreneurship and creative destruction dimension appears not to be very relevant; thus starting challenging the Schumpeterian model. Let us then start by checking if the human capital theory is more relevant in the case of the KEI composite, for doing so we go deeper than the dimensional hierarchical level.
The following conclusions can be drawn from our analysis. While the number of Ph.Ds seems to play a role in explaining the success of a knowledge based economy (all countries with an high number of Ph.Ds, except Portugal, are top countries in the KEI median ranking), the same result does not apply to percentage of working population with a tertiary education (very clear the case of Italy where the number of working population with a tertiary education is extremely high, but the number of Ph.Ds is small). Participation to life long learning seems also to be a success factor, although not for all top countries. In sum, we could state that the human capital theory seems to be corroborated by the KEI results roughly.

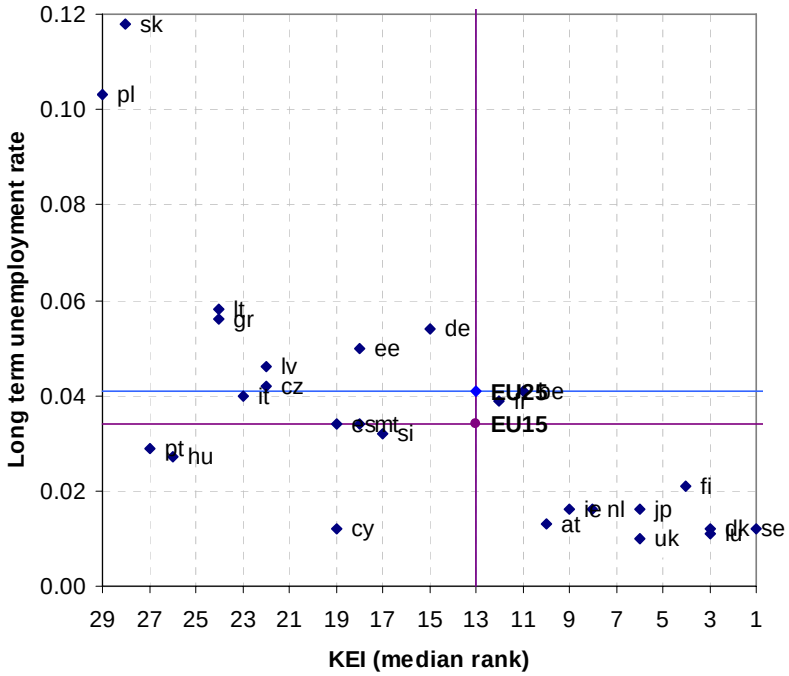
However, if one considers, what probably is the most important Schumpeterian indicator, i.e. Gross domestic expenditure on research and experimental development, the relationship with the KEI median is a clear cut one: countries which invest in research are top countries in a

KBE. Research is a key driver for a KBE surely, thus the endogenous growth idea seems also corroborated.

Let us now look at other concepts embedded in the idea of a knowledge economy. A popular one is *eco-efficiency*. i.e. the idea that advanced economies, such as knowledge based economies, are more environmental friendly since they use less material goods and are more energy efficient in productive activities. Unfortunately, the *Jevons' paradox* teaches us that an increase in efficiency in using a resource leads, in the medium to long term, to an increased consumption of that resource (rather than a decrease). This is a classic example of the co-existence of opposite causal links emerging when considering the same process at different (spatial, temporal) scales. Trade-offs also emerge when considering different attributes of performance or when adopting different disciplinary analyses. Sustainability literature clearly emphasizes that environmental preservation has an economic cost and economic growth has an environmental cost, no escapes from this conflict exists. These arguments seem corroborated by the KEI measure. In fact, as one can see, no clear relationship between environmental performance and a KBE exists.



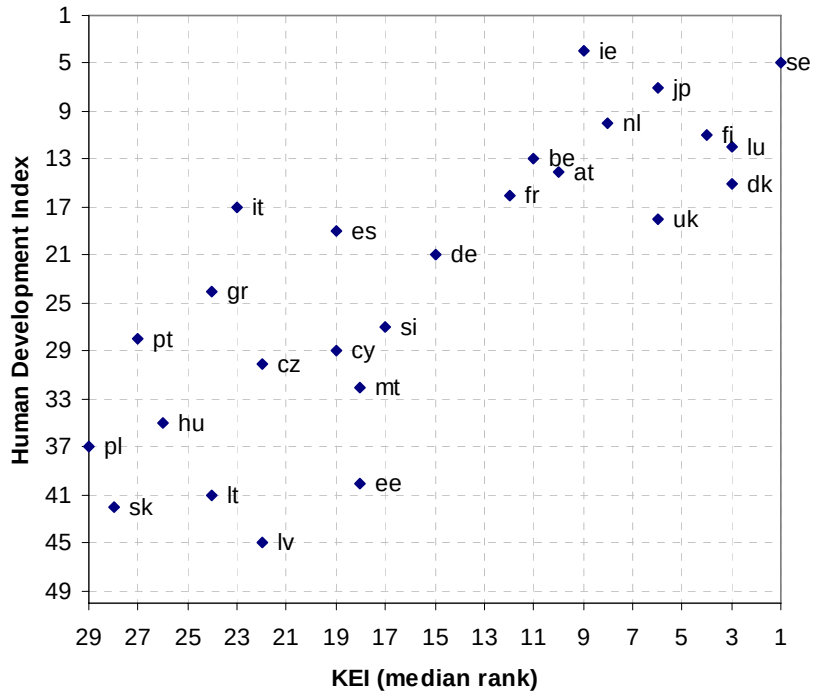

Another interesting aspect of a KBE is unemployment. Job creation can be successfully increased in the short term, by a slowdown of the rate of technological progress. As noted by the Kok report, this is exactly what has recently happened inside the European Union. But in a longer time horizon, this strategy may easily cause the collapse of the economy given that non-specialized low productivity jobs can easily be substituted by lower wage labour in other parts of the world. Thus, in the short term technological progress and job creation are conflicting objectives but they might be compatible in the long period if a right balance (i.e. compromise) between flexibility and employment security is found. If the relationship between long term unemployment rate and the KEI median ranking is displayed, this compatibility between technological progress and job creation seems to be true. All top countries in the KEI measure are presenting an extremely low long term unemployment rate. This aspect of a KBE seems extremely interesting and encouraging.

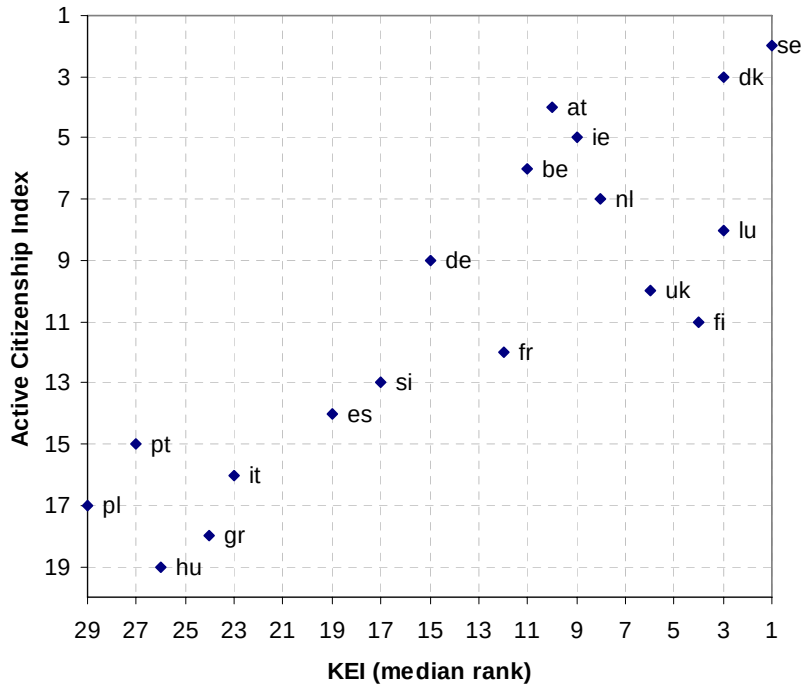



Another common statement about a KBE is that income distribution inequalities are reduced. This statement appears difficult to corroborate by examining the relationship between the KEI measure and the income distribution inequality. No precise relationship exists and when it seems to exist, in reality might simply be a corroboration of the classical Kuznets curve model, where income distribution inequality is supposed to decrease when GDP increases (one should not forget that KEI and GDP are correlated).

As an external benchmark, we look at the relationship between the KEI composite and the Human Development Index. The relationship found seems again a corroboration of the human capital theories, in fact the correlation between KEI and the HDI is extremely high. A peculiar behaviour is the one of Italy and Spain whose HDI is high but the KEI performance is poor.

In this context a relevant index to use as a final external benchmark might be the Active Citizenship Index. This index produced at JRC by CRELL (Centre for Research on Lifelong Learning) is an attempt to measure a component of the social capital, and thus can be considered as complementary to the human capital measurements, which look more at individual skills. It is interesting to note that this index correlates very much with the KEI median ranking, thus it might open interesting research questions on the importance of the social component in a knowledge based economy.




4) To reduce the number of individual indicators, we first undertook both forward and backward stepwise regression, so as to identify those indicators within a KEI dimension that represent (in a linear fashion) the dimension. We also applied forward/stepwise regression to choose those indicators that represent best the overall KEI rank. We finally crosschecked, using canonical analysis, whether the subset of indicators describes reliably the set of the seven KEI dimensions and the overall KEI. The following 23 indicators (from a total of 115) are proven sufficient to describe 97.4% of the variation in the overall set (KEI and its seven dimensions).

**Production and diffusion of ICT (A1)**

ICT value-added (% of total business sector value added)

SMEs ordering over the Internet (% of total SMEs)

Individuals using the internet for banking (% total)

**Human resources, skills and creativity (A2)**

Pisa reading literacy of 15y (average score)

Total researchers (per 1000 labour force in FTE)

Participation in lifelong learning (% of working 25-64y)

Employed in creative occupations (% total)

**Knowledge production and diffusion (A3)**

BERD performed in service industries (%)

EPO high tech patent applications (per million pop.)

Triadic patent families (per million pop.)

**Innovation, entrepreneurship and creative production (A4)**

Firm entries (birth rate)

GDP (per capita)

Early-stage venture capital ( % GDP)

SMEs reporting non technological change (%)

**Economic outputs (B1)**

GDP per capita (in PPS)

Real GDP growth rate

Total employment growth

**Social performance (B2)**

Long term unemployment rate

Hampered in daily activities because of chronic conditions

Rooms per person by tenure status and type of housing

**Internationalisation (C1)**

Technology balance of payments (% GERD)

Co authorship share on international S&E articles

Foreign PhD students (% total PhD enrolment)

5) A nasty question at this point might be: *is all this effort we have done of any use?* Even if we have very reliable rankings, which is the policy utility of knowing that a country is overall better than another one or vice versa? This kind of criticism is often put to composite indicators, thus it is worthy to tackle this issue.

Indeed we have already seen that rankings are already giving very interesting information for policy purposes. For example, in the KEI framework, we succeeded to find out clear success stories, i.e. top performance countries, and clear policy drivers. However, one should note that for the majority of indicators used in any assessment exercises no clear reference point is available, for instance, when GDP is used nobody knows the ideal value of a Country GDP, thus it is quite common to compare with other Countries GDP, e.g. the USA one. In general to get a set of reference values to be used as benchmarks, two options exist:

- To compare any country performance with a relevant average (in our case EU15 or EU25).
- To construct an "ideal point" defined by choosing the best values reached in any single individual indicator by a country. This is a well established technique in multi-criteria evaluation literature and has the advantage of indicating "real world ideal values".

In KEI both approaches were followed. The performance of each single country is synthesized by comparing its scores on dimensions and sub-dimensions with the EU25 average. Later on country profiles are shown in details, where both EU25 average and the idea of a best performing country are used for deriving policy priorities.

By looking at the following Table, we have both synthetic and analytic information on single country performance. In fact we know the total numbers of sub-dimensions which are above (+), close (0) or below (-) the EU25 average, thus allowing a quick scoring of countries; but at the same time, it is also possible to derive policy suggestions since all the sub-dimensions are scored. To give some illustrative examples, Finland is clearly a top performing country since it is above or close to the EU25 average for the majority of sub-dimensions. The only plausible policy priorities since the performance is below the average are Entrepreneurship, Organizational indicators, Knowledge production and diffusion and Economic Structure. Entrepreneurship, Organizational indicators and Economic Structure seem problematic for another top performing country, Sweden. For Sweden, Mobility and Knowledge flows also offer space for improvement. On the other side, if one examines the performance of countries such as Italy (above in the average only in Government ICT and Organizational indicators), Portugal (+ only in Financing of innovation and employment and economic welfare) or Greece (+ only in Economic impact of ICT, Income and Employment) it is clear that the space for improvement is enormous, but of course this does not necessarily mean that their governments wish to pursue the objective of being a KBE, it is important to remember that a KBE is one of the possible models that a country may choose and the fact that a poor performance exists might simply mean that this scope is not a policy objective for that country. An interesting result is that EU 15 is NOT always equal or superior to the average of EU25. It is actually below EU25 average in three sub-dimensions: Organizational indicators, Environment and Economic structure; in these areas the enlargement has then lead to an improvement of the average EU performance.

| Dimension | Sub-dimension | AT | BE | CY | CZ | DE | DK | EE | ES | EU15 | FI | FR | GR | HU | IE | IT | JP | LT | LU | LV | MT | NL | PL | PT | SE | SI | SK | UK | USA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production and diffusion of ICT | Economic impact of ICT | 0 | 0 | - | 0 | 0 | + | + | - | 0 | + | 0 | + | 0 | + | 0 | + | - | 0 | + | - | + | - | - | + | - | - | + | + |
| | Internet use by firms | 0 | 0 | - | - | + | + | - | - | 0 | + | + | - | - | + | - | + | - | 0 | - | + | 0 | - | - | + | 0 | - | + | + |
| | Internet use by individuals | 0 | 0 | - | - | + | + | + | - | + | + | + | - | - | - | - | + | - | + | - | - | + | - | - | + | - | - | + | + |
| | Government ICT | + | 0 | - | - | 0 | + | + | 0 | 0 | + | + | - | - | 0 | + | + | - | + | - | 0 | 0 | - | - | + | - | - | - | + |
| Human resources, skills and creativity | General education | - | 0 | 0 | - | 0 | - | - | - | 0 | + | 0 | - | - | + | - | - | 0 | - | - | - | 0 | - | - | + | - | - | 0 | 0 |
| | Human resource in S%T education | 0 | 0 | 0 | - | 0 | + | + | 0 | 0 | + | + | - | - | + | - | + | 0 | + | 0 | - | - | - | - | + | - | 0 | 0 | + |
| | Skills | 0 | 0 | 0 | - | - | + | - | - | 0 | + | - | - | - | - | - | + | - | 0 | 0 | - | + | - | - | + | + | - | + | + |
| | Creativity | 0 | + | - | 0 | + | + | 0 | - | 0 | + | 0 | - | - | + | 0 | + | - | + | - | - | + | - | - | + | - | - | + | + |
| | Mobility | + | 0 | + | - | 0 | + | + | + | 0 | + | + | 0 | - | + | - | + | + | - | + | 0 | + | - | 0 | - | + | - | + | + |
| Knowledge production and diffusion | R&D | + | 0 | + | - | + | + | 0 | - | 0 | + | + | - | - | - | - | + | 0 | 0 | 0 | 0 | 0 | - | - | + | 0 | - | 0 | + |
| | Patents | + | 0 | 0 | - | + | + | - | - | 0 | + | 0 | - | - | - | - | + | - | + | - | - | + | - | - | + | - | - | 0 | + |
| | Bibliometrics | - | 0 | - | - | 0 | + | - | - | 0 | + | 0 | - | - | - | - | + | - | - | - | 0 | + | - | - | + | - | - | + | + |
| | Knowledge flows | - | - | - | - | - | - | - | - | 0 | + | - | - | - | - | - | 0 | - | - | + | - | - | - | 0 | 0 | + | + | - | - |
| | Total investment in intangibles | - | - | 0 | - | - | - | - | - | 0 | 0 | 0 | - | + | + | - | + | - | + | - | + | 0 | - | - | - | - | - | + | + |
| Innovation, enterpreunership and ctreative diffusion | Entrepreneurship | - | 0 | - | - | + | - | 0 | 0 | 0 | - | 0 | - | + | - | - | 0 | 0 | 0 | 0 | - | - | 0 | - | - | - | 0 | + | - |
| | Demand for innovative products | 0 | - | 0 | 0 | 0 | + | + | 0 | 0 | 0 | 0 | 0 | 0 | + | - | 0 | 0 | + | 0 | - | 0 | - | - | + | 0 | + | + | 0 |
| | Financing of innovation | 0 | + | + | - | + | + | + | 0 | + | + | + | 0 | - | + | 0 | + | + | + | + | 0 | 0 | - | + | + | 0 | 0 | + | + |
| | Market innovation outputs | 0 | - | - | 0 | - | 0 | 0 | - | 0 | 0 | - | 0 | - | 0 | - | + | - | + | - | + | 0 | - | - | 0 | + | 0 | + | 0 |
| | Organisational indicators | - | - | 0 | + | - | - | - | + | - | - | + | 0 | + | - | + | 0 | + | - | 0 | + | + | + | 0 | - | + | + | - | - |
| Economic outputs | Income | + | + | + | 0 | 0 | 0 | + | 0 | 0 | + | 0 | + | 0 | + | - | 0 | + | + | + | - | 0 | 0 | - | + | + | 0 | + | + |
| | Productivity | + | + | - | - | 0 | 0 | 0 | + | 0 | 0 | + | 0 | - | + | 0 | + | - | + | - | - | 0 | - | - | 0 | 0 | - | 0 | + |
| | Employment | 0 | - | + | 0 | 0 | + | - | + | 0 | + | - | + | - | + | - | + | - | + | 0 | - | 0 | - | 0 | + | 0 | - | + | + |
| Social performance | Environmental | + | 0 | - | - | - | 0 | - | - | - | 0 | 0 | - | 0 | - | 0 | - | - | - | + | - | 0 | - | - | + | 0 | - | - | 0 |
| | Employment and economic welfare | + | 0 | + | 0 | 0 | + | - | 0 | 0 | 0 | 0 | - | + | + | 0 | + | - | + | 0 | + | + | - | + | + | + | - | + | + |
| | Quality of life indicators | + | + | + | - | 0 | + | - | + | 0 | 0 | 0 | 0 | - | + | 0 | 0 | - | + | - | 0 | + | - | - | + | - | - | - | + |
| Internationalisation | Trade | 0 | + | 0 | 0 | 0 | 0 | - | 0 | 0 | + | 0 | - | 0 | + | 0 | 0 | - | + | - | 0 | + | 0 | - | + | 0 | 0 | 0 | 0 |
| | Knowledge production and diffusion | 0 | + | 0 | - | - | - | - | 0 | + | - | 0 | - | - | 0 | - | - | - | + | - | 0 | 0 | - | - | 0 | - | - | + | 0 |
| | Economic structure | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Human resources | + | + | + | 0 | + | + | - | 0 | 0 | 0 | + | 0 | - | + | - | + | - | + | - | 0 | + | - | 0 | 0 | - | - | + | + |
| Number of sub-dimensions | **Above the EU25** | 10 | 8 | 8 | 1 | 8 | 17 | 8 | 5 | 3 | 17 | 10 | 3 | 4 | 16 | 2 | 18 | 4 | 17 | 6 | 5 | 12 | 1 | 2 | 19 | 7 | 3 | 17 | 19 |
| | **Close to the EU25** | 12 | 14 | 9 | 9 | 13 | 5 | 5 | 10 | 23 | 8 | 14 | 8 | 5 | 3 | 8 | 7 | 5 | 5 | 8 | 9 | 13 | 3 | 5 | 5 | 8 | 6 | 6 | 6 |
| | **Below the EU25** | 7 | 7 | 12 | 19 | 8 | 7 | 16 | 14 | 3 | 4 | 5 | 18 | 20 | 10 | 19 | 4 | 20 | 7 | 15 | 15 | 4 | 25 | 22 | 5 | 14 | 20 | 6 | 4 |

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# 1. Introduction

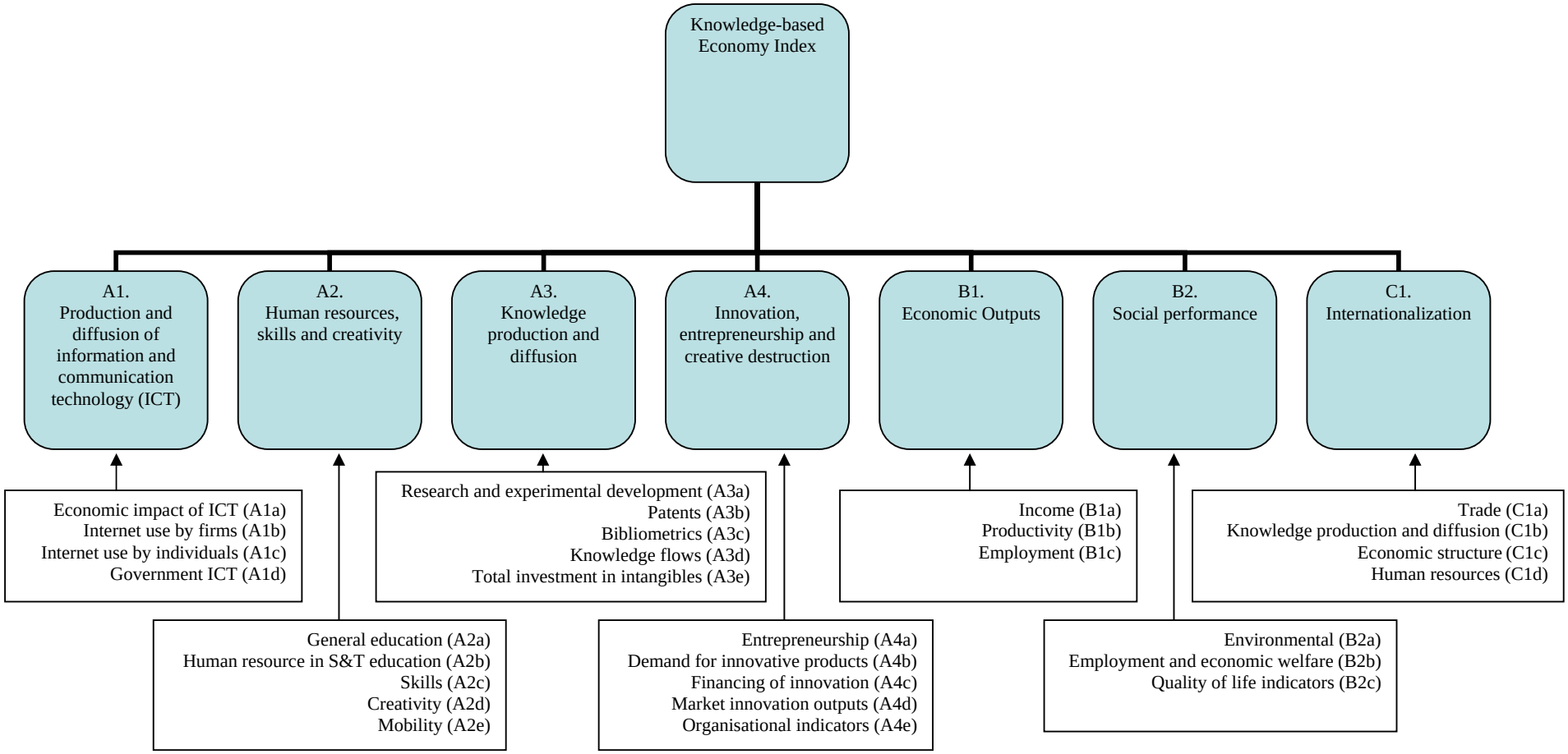
In the KEI conceptual framework of the knowledge economy, a total of 115 individual indicators have been selected to measure the sub-dimensions of the KBE (see Figure 1). The number of indicators per sub-dimensions varies between 1 and 12. For example, the Skills (A2c) sub-dimension includes only one indicator, whilst the Research and experimental development (A3a) sub-dimension includes twelve indicators, all related to different expressions of R&D from either government or business perspective. The high number of individual indicators rises the issue of robustness of the ranking obtained by their aggregation into one composite measure.

To tackle this issue a sensitivity analysis is a fundamental step of the KEI composite indicator. In particular, in building the KEI composite an innovative methodological assumption has been made, i.e. we consider as the final composite index the frequency of all rankings obtained by means of all the simulations carried out. This allows us to deal with the criticism, often made to composite indicators, that rankings are presented as they were under conditions of certainty while it is well known that this is not true in general terms. Most practitioners compute a composite indicator by a simple weighted summation mathematical model . Sometimes it is acknowledged that the ranking obtained is subject to some uncertainty, but this issue is treated as a kind of mathematical appendix for technical readers, and all policy suggestions are derived under the assumption of the linear aggregation model. Here the ranking presented is the one derived by considering the whole spectrum of uncertainty. It is important to note that this is a peculiar characteristic of the KEI composite.

This report answers five main research questions:

6. Is it possible to measure the knowledge economy?
7. What are the drivers of the knowledge economy?
8. How does knowledge economy relate to other complex dimensions?
9. Is it possible to reduce the total number of individual indicators of KEI conceptual framework without loosing any relevant information?
10. Are rankings useful at all for deriving policy suggestions?

**Figure 1. KEI Conceptual framework of a Knowledge-based Economy**



# 2. Measuring the Knowledge-based Economy: The KEI Composite Indicator and its Main Drivers

The selection of an appropriate methodology is central to any exercise attempting to capture and summarize the interactions among the individual indicators included in a composite indicator. The literature review offered in the JRC/OECD (2005) Handbook on composite indicators discusses the plurality of the approaches that have been used in building a composite indicator and shows that some of the methodologies are suited (more or less) to the purposes for which they are employed. In particular, the authors stress the need for an explicit conceptual framework for the index, and the usefulness of multivariate analysis prior to the aggregation of the individual indicators. They review tools for imputation of missing information, methodologies for weighting and aggregation, and finally methods for assessing the robustness of the index using uncertainty and sensitivity analysis. In Table 1 we present a stylised 'checklist' to be followed in the construction of a composite indicator, which we have rearranged from the information contained in the Handbook.

**Table 1. Checklist for building a composite indicator**

| Step | At the end of this Step the constructor should have… |
|---|---|
| **Theoretical framework**<br>provides the basis for the selection and combination of variables into a meaningful composite indicator under a fitness-for-purpose principle (involvement of experts and stakeholders is envisaged at this step) | • A clear understanding and definition of the multidimensional phenomenon to be measured.<br>• A nested structure of the various sub-groups of the phenomenon (if needed).<br>• A list of selection criteria for the underlying variables, e.g., input, output, process. |
| **Data selection**<br>should be based on the analytical soundness, measurability, country coverage, and relevance of the indicators to the phenomenon being measured and relationship to each other. The use of proxy variables should be considered when data are scarce (involvement of experts and stakeholders is envisaged at this step) | • Checked the quality of the available indicators.<br>• Discussed the strengths and weaknesses of each selected indicator.<br>• Created a summary table on data characteristics, e.g., availability (across country, time), source, type (hard, soft or input, output, process) |
| **Data treatment**<br>consists of<br>- imputing missing data (e.g. single, multiple imputation);<br>- examining whether there are outliers (as they may become unintended benchmarks;<br>- taking logarithms of some indicators values, so that differences at the lower levels matter more;<br>- transforming highly skewed data (e.g. square root, or logarithms). | • A complete data set without missing values<br>• A measure of the reliability of each imputed value that allows assessing the impact of imputation on the composite indicator results.<br>• Discussed the presence of outliers in the dataset<br>• Made scale adjustments, if necessary.<br>• Transformed the indicators, if necessary |
| **Multivariate analysis**<br>should be used to study the overall structure of the dataset, assess its suitability, and guide subsequent methodological choices (e.g., weighting, aggregation) | • Checked the underlying structure of the data along the two main dimensions, namely individual indicators, countries (by means of suitable multivariate methods, e.g., PCA, FA, cluster analysis).<br>• Identified groups of indicators or groups of countries that are statistically "similar" and provided an interpretation of the results.<br>• Compared the statistically-driven structure of the data set to the theoretical framework and discussed eventual differences. |
| **Normalisation**<br>should be carried out to render the variables comparable | • Selected a suitable normalisation procedure(s) with reference to the theoretical framework and the data properties. |
| **Weighting and aggregation**<br>should be done along the lines of the underlying theoretical framework | • Selected the appropriate weighting and aggregation procedure(s) with reference to the theoretical framework.<br>• Discussed whether compensability among indicators should be allowed. |
| **Uncertainty and sensitivity analysis**<br>should be undertaken to assess the robustness of the composite indicator in | • Considered alternative methodological approaches to build the index, and if available, alternative conceptual scenarios. |

| | |
|---|---|
| terms of e.g., the mechanism for including or excluding an indicator, the normalisation scheme, the imputation of missing data, the choice of weights, or the aggregation method. | • Identified the sources of uncertainty in the development of the composite indicator and provided the composite scores and ranks with confidence intervals.<br>• Conducted sensitivity analysis of the inference (assumptions), e.g. to show what sources of uncertainty are more influential in determining the scores/ranks. |
| **Links to other indicators**<br>should be made to correlate the composite indicator (or its dimensions) with existing (simple or composite) indicators as well as to identify linkages through regressions. | • Correlated the composite indicator with relevant measurable phenomena, accounting for the variations of the composite indicator as determined through sensitivity analysis.<br>• Develop data-driven narratives on the results.<br>• Performed causality tests (if time series data are available). |
| **Decomposition into the underlying indicators**<br>should be provided to reveal the main drivers for good/bad performance. Transparency is primordial to good analysis and policymaking. | • Profiled country performance at the indicator level to reveal what is driving the composite indicator results.<br>• Performed causality tests (if time series data are available).<br>• Performed path analysis to identify if the composite indicator results are overly dominated by a small number of indicators and to explain the relative importance of the sub-components of the composite indicator.<br>• Performed correlation analysis between the composite indicator and (a) the underlying indicators, (b) the dimensions, and among dimensions themselves, so as to show how the different components of the index are associated to each other. |
| **Visualisation of the results**<br>should receive proper attention, given that the visualisation can influence (or help to enhance) interpretability. | • Identified a coherent set of presentational tools for the targeted audience.<br>• Selected the visualisation technique which communicates the most information.<br>• Visualised the results of the composite indicator in a clear and accurate manner. |

Note: rearranged (and extended) from the JRC/OECD (2005) Handbook on composite indicators

The methodological approach to build the KEI composite involved six main steps:

**1) Imputation of missing data**

Missing data in 2004 were imputed using two different approaches: splines or multiple imputation (the entire dataset 2000-2004 was used for the imputation). Two datasets were thus used in the analysis described next.

**2) Directional adjustment of indicators**

Data were next adjusted, so that higher values correspond to higher levels of knowledge economy. A (1-value) transformation was applied to 18 indicators (for example, green house gas emissions per capita, amount of waste generated, long term unemployment rate, inequality of income distribution, unadjusted gender pay gap, serious accidents at work, etc.). This step was applied to both datasets.

**3) Standardisation of indicators**

All indicators were transformed into z-scores by subtracting the sample mean and dividing by the sample standard deviation. This step was applied to both datasets.

**4) Factor Analysis within each sub-dimension**

The indicators (z-scores) were weighted and aggregated into sub-dimensions using factor analysis. This step was applied to both datasets.

**5) Multi-modelling approach**

A multi-modelling approach was applied to weight and further aggregate the sub-dimensions scores into dimensions and finally into a composite indicator (see Table 3). The approach consisted of about ***2,000 simulations*** (saturated sampling) based on combinations of the:

- imputation method (dataset deriving from either splines or multiple imputation),
- number of sub-dimensions (all 29 sub-dimensions included or one-at-time excluded)
- number of dimensions (all seven dimensions included or one-at-time excluded)
- normalisation of the 29 sub-dimensions scores (z-scores or min-max),
- structure relating the sub-dimensions to the dimensions (preserved or not),
- weighting method (factor analysis, equal weighting, data envelopment analysis),
- aggregation rule (additive, multiplicative, non-compensatory multi-criteria analysis).

**6) Calculation of dimensions and KEI ranks**

The ***frequency matrix*** of a country's rank in each of the seven dimensions and the overall KEI was calculated across the ~2,000 scenarios. Besides the frequency matrix, the median rank per country was selected for further analysis of the associations between KEI and its main dimensions, or other complex concepts, such as human development.

**Table 2: Methodological scenarios for the development of the KEI composite**

| | | Aggregation function | | |
|---|---|---|---|---|
| | | Additive (linear) | Multiplicative (geometric averaging) | Non-compensatory multi-criteria analysis |
| **Sub-dimensions included** | All (total 29) | • | • | • |
| | One-at-a-time excluded | • | • | • |
| **Dimensions included** | All (total 7) | • | • | • |
| | One-at-a-time excluded | • | • | • |
| **Pillar Structure** | Preserved | • | • | • |
| | Not preserved | • | • | • |
| **Normalisation** | z-scores | • | • | |
| | Min-max | • | • | |
| | Raw data | | | • |
| **Weighting** | Factor analysis | • | • | • |
| | Equal weighting | • | • | • |
| | Data envelopment analysis | • | | |

An important point we would like to insist here is that the scenario analysis used for building the KEI frequency matrixes is aimed at dealing with the issue of uncertainty underlying the construction of any composite indicator, in the most comprehensive way as possible (see Table 2). The results obtained by using a composite indicator, depend heavily on the problem's structuring phase. In general main delicate issues are:

1. *Quality of the information available*. In the KEI project particular attention has been devoted to this issue. We then take for granted that the data base provided contains good quality data. However, one should note that even if a data base has been submitted to rigorous quality check, the following problems have still to be tackled to arrive at a composite measure:
    - the consideration of measurement error in the data,
    - the imputation of missing data,
    - the treatment of outliers and extreme values,
    - the transformation of skewed indicators,
    - the standardization/normalization of the data (e.g., re-scaling, standardisation).
2. *Indicators chosen* i.e. which representation of reality we are using. A set of indicators is not the reality, but it is simply a descriptive model of it. It is important then to check the relevance and the explicative capacity of the theoretical framework used. The way we chose to deal with this issue is by looking at the sensitivity of results to the exclusion/inclusion of different individual indicators and dimensions. Although, this analysis may look very technical in nature, in reality a social component is also present. In fact to consider or not a given dimension, normally has behind a long story

of social, political and scientific controversy. To give an example, the environmental dimension nowadays is considered very important in almost any analysis, however this was not true 30 years ago, mainly because the social concerns on the environment in the past were very limited. As a conclusion, we should remember that to include or exclude a given dimension or a set of indicators means to deal or not with peculiar social concerns and social actors.

3. *Direction of each indicator* (i.e. the bigger the better or vice versa, this choice sometimes is not obvious).
4. *The weighting of the indicators* e.g., equal weighting, factor analysis, expert opinion and so on. This again has a technical and a more socio-political component. In the case of the KEI composite, we have considered the following weighting assumptions:
    - equal weights to individual indicators (thus dimensions weight is determined by the total number of individual indicators per dimension),
    - equal weight to the seven dimensions (thus weights to individual indicators vary according to their number per dimension),
    - Factor analysis (thus checking possible double counting),
    - Endogenous weights derived by data envelopment analysis. These weights allow to check how stable is a bottom position of a country – since the best set of weights for that country is used – and then to derive policy priority.
5. *Ranking method used*. When a set of individual indicators is aggregated, a fundamental point to be considered is the one of compensability. *Compensability* refers to the existence of trade-offs, i.e. the possibility of offsetting a disadvantage on some criteria by a sufficiently large advantage on another criterion, whereas smaller advantages would not do the same. Thus a preference relation is non-compensatory if no trade-off occurs and vice versa. The use of weights combined with intensity of preference in the criteria values originates compensatory multi-criteria methods and gives the meaning of trade-offs to the weights. On the contrary, the use of weights combined with ordinal criteria values originates non-compensatory aggregation procedures and gives the weights the meaning of importance coefficients. To give an illustrative example of the compensability issue, we assume that a composite indicator is formed by four indicators: inequality, environmental degradation, GDP per capita and unemployment. Two regions have respective values (21, 1, 1, 1) and (6, 6, 6, 6). These regions would have equal composite indicator scores if the aggregation was additive, i.e. fully compensatory. Yet, these regions represent very different social conditions that would not be reflected in the composite. If the

aggregation rule is only partially compensatory, the use of a geometric aggregation, where $CI_n = \prod_{m=1}^{M} y_{mn}^{w_m}$ is the right solution. In that case, the first region would have a much lower composite indicator score (=2.14) than the second (=6.00). Although various functional forms for the aggregation of indicators into a composite indicator have been developed in the literature in the standard practice, a composite indicator $CI_n$ for a given country *n*, can be considered a weighted linear aggregation function applied to a set of *m* ( $m = 1,2,...,M$ ) normalised variables. As noted in previous KEI WPs by the JRC team, the use of nonlinear aggregation rules to construct composite indicators is ***compulsory*** for reasons of theoretical consistency when weights have the meaning *of importance coefficients* (i.e. the bigger the weight the more important the individual indicator*)* or when the assumption of preferential independence among indicators does not hold. Moreover, in case of linear-based composite indicators, compensability among the different individual indicators is always assumed, which implies complete substitutability among the indicators considered. From a normative point of view, such a complete compensability ***is often not desirable.*** For all these reasons, here we also use a nonlinear/noncompensatory Condorcet consistent aggregation rule for computing the KEI composite indicator (this procedure has also been proposed in previous JRC KEI WPs).

The KEI composite indicator results are the following:

**Knowledge Economy Index**

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sweden | 54 | 46 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Denmark | | | 55 | 30 | 14 | | | | | | | | | | | | | | | | | | | | | | | | |
| Luxembourg | 36 | 4 | 14 | 25 | 4 | 7 | 7 | 4 | | | | | | | | | | | | | | | | | | | | | |
| Finland | | 18 | 23 | 29 | 9 | 11 | 11 | | | | | | | | | | | | | | | | | | | | | | |
| USA | 11 | 32 | 2 | 4 | 39 | 9 | 4 | | | | | | | | | | | | | | | | | | | | | | |
| Japan | | | 4 | 7 | 18 | 32 | 36 | | | 4 | | | | | | | | | | | | | | | | | | | |
| UK | | | 2 | 5 | 16 | 38 | 39 | | | | | | | | | | | | | | | | | | | | | | |
| Netherlands | | | | | | | | 86 | 4 | | 4 | | | 7 | | | | | | | | | | | | | | | |
| Ireland | | | | | | | 4 | | 61 | 14 | 4 | 9 | 9 | | | | | | | | | | | | | | | | |
| Austria | | | | | | | | | 18 | 50 | 18 | 7 | | 7 | | | | | | | | | | | | | | | |
| Belgium | | | | | | | | 11 | 4 | 11 | 57 | 16 | 2 | | | | | | | | | | | | | | | | |
| France | | | | | | 4 | | | 14 | 18 | 11 | 54 | | | | | | | | | | | | | | | | | |
| EU15 | | | | | | | | | | | 4 | | 57 | 39 | | | | | | | | | | | | | | | |
| EU25 | | | | | | | | | | 4 | 4 | 14 | 32 | 39 | 7 | | | | | | | | | | | | | | |
| Germany | | | | | | | | | | | | | | 7 | 79 | 4 | 7 | 4 | | | | | | | | | | | |
| Slovenia | | | | | | | | | | | | | | | 7 | 41 | 38 | 14 | | | | | | | | | | | |
| Estonia | | | | | | | | | | | | | | | | 4 | 36 | 25 | 21 | 11 | 4 | | | | | | | | |
| Malta | | | | | | | | | | | | | | | 7 | 13 | 9 | 21 | 23 | 27 | | | | | | | | | |
| Cyprus | | | | | | | | | | | | | | | | 36 | 7 | 4 | 23 | 23 | 7 | | | | | | | | |
| Spain | | | | | | | | | | | | | | | | 4 | 4 | 32 | 25 | 29 | 7 | | | | | | | | |
| Czech. Rep. | | | | | | | | | | | | | | | | | | | 4 | 7 | 30 | 39 | 5 | 7 | 7 | | | | |
| Latvia | | | | | | | | | | | | | | | | | | | | | 20 | 36 | 11 | 21 | 7 | | 5 | | |
| Italy | | | | | | | | | | | | | | | | | | | | | 29 | 18 | 9 | 29 | 9 | 7 | | | |
| Greece | | | | | | | | | | | | | | | | | | | | 4 | 4 | 4 | 29 | 18 | 21 | 7 | 14 | | |
| Lithuania | | | | | | | | | | | | | | | | | | | | | | 4 | 41 | 13 | 32 | 11 | | | |
| Hungary | | | | | | | | | | | | | | | | | | | | | | | 2 | 13 | 13 | 57 | 2 | 14 | |
| Portugal | | | | | | | | | | | | | | | | | | | 4 | | | | 4 | | 7 | 11 | 61 | 14 | |
| Slovakia | | | | | | | | | | | | | | | | | | | | | | | | | 4 | 7 | 18 | 71 | |
| Poland | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 100 |

*Legend:*

Frequency lower 15%

Frequency between 15 and 30%

Frequency between 30 and 50%

Frequency greater than 50%

This is a novel approach to the presentation of results of a composite indicator. Our objective here is to synthesize and make explicit the uncertainty contained in the country ranking. For each country it is indicated the percentage of times it was in a given rank in all the 2,000 simulations, one can see that e.g. Poland was 100% of times in the last position, and Sweden 54% of times in the first position and 46% in the second.

A first consideration is that the overall ranking is very stable; in fact considering the whole 2,000 simulations, all countries are clustered unambiguously. No doubt the top performing countries are Sweden, Denmark Luxembourg, Finland and the USA. Then it follows the group Japan, United Kingdom, Netherlands and Ireland (where Japan and UK are slightly better than the other two). Austria, Belgium, France and Germany form the next group (where Germany is slightly worst than all the other three). All the rest of countries can be considered with a bad performance with respect to a knowledge based economy. However, we could still split this class into two subsets: a first one including Slovenia, Estonia, Malta,

Cyprus, Spain, the Czech Republic, Latvia, Italy, Greece and Lithuania is a bit better than the worst performing group including Hungary, Portugal, Slovakia and Poland. An interesting result is also that overall both USA and Japan have a better performance than EU 15 and EU 25.

To better understand the influence of the conceptual model used to derive these results, we have computed country rankings by using the subset of individual indicators belonging to each one of the seven dimensions, thus other seven rankings have been obtained. The objective of this analysis is to check if in some single dimensions, poor performing countries might present an improvement or vice versa, good performance countries a worsening. Of course rankings are obtained again by considering the whole spectrum of uncertainty related to the computations.

Overall, dimensionsA1(Production and diffusion of ICT), A2 (Human resources, skills and creativity) and A3 (knowledge production and diffusion) supply rankings correlated with the KEI composite indicator highly. In these three dimensions Finland is always the top country, but Sweden is always very close to it. In the bottom of the ranking we can find both Cyprus and Portugal, but Poland is never too far from the last position. On dimension A1 Italy has a net improvement but it is still far from the top performing countries. The grouping of countries is very similar to the one of the KEI composite (with all the seven dimensions). On the contrary, A4, B1, B2 and C1 produce country rankings with bigger differences.

On dimension A4 (Innovation, entrepreneurship and creative destruction), Italy ranks as the bottom country with a very high degree of credibility (frequency= 11% rank 27, 32% rank 28 and 57% rank 29). Also countries like The Netherlands, Belgium, Austria and Germany show a very poor performance. Finland is closer to medium performance countries than to top countries. Spain improves its rank position considerably. Sweden is still a top performing country. Poland improves its performance surely, but it is very volatile (it occupies positions in the range from the 7-th to the 24-th and the frequency it is never higher than 14% in any position).

Taking into account dimension B1 (Economic outputs) only, big surprises exist. Although the bottom countries are very similar to the ones supplied by other dimensions, Greece (5-th position) and Spain (4-th position) are extremely well performing. Cyprus is also improving

considerably. Denmark, Finland and Sweden are instead much worse, since they perform as medium countries.

The same argument applies to dimension C1 (Internationalisation). The bottom countries are quite robust a part from Cyprus which is performing around the 7-th and 8-th positions. Portugal is in a better position than Finland (which is very volatile but never above the 17-th rank). Denmark and Sweden are between positions 11 and 13. Top performing countries are Luxembourg, Belgium, Austria and the USA.

On dimension B2 (Social performance), top countries are Denmark, Sweden, Austria and the Netherlands. Particularly strong is the worsening of Finland which is around the 13-th position. Germany is also performing very badly (frequencies are clustered around positions 22 and 23). Improvements are shown by Hungary, Italy, Portugal and Spain which perform as middle ranked countries.

## Production and diffusion of ICT (A1)

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Finland | 54 | 46 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sweden | 46 | 54 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Denmark | | | 89 | | | 11 | | | | | | | | | | | | | | | | | | | | | | | |
| USA | | | 11 | 54 | 36 | | | | | | | | | | | | | | | | | | | | | | | | |
| UK | | | | 39 | 43 | 18 | | | | | | | | | | | | | | | | | | | | | | | |
| Japan | | | | 7 | 21 | 57 | 14 | | | | | | | | | | | | | | | | | | | | | | |
| Luxembourg | | | | | | 14 | 61 | 11 | 4 | 4 | | | 4 | | | 4 | | | | | | | | | | | | | |
| Netherlands | | | | | | | 14 | 57 | 18 | 11 | | | | | | | | | | | | | | | | | | | |
| Germany | | | | | | | | 29 | 21 | 39 | 7 | 4 | | | | | | | | | | | | | | | | | |
| Estonia | | | | | | | 4 | 11 | 46 | 39 | | | | | | | | | | | | | | | | | | | |
| France | | | | | | | | | 4 | | 68 | 18 | | 11 | | | | | | | | | | | | | | | |
| Austria | | | | | | | | | 7 | 7 | 18 | 29 | 39 | | | | | | | | | | | | | | | | |
| EU15 | | | | | | | | | | | 4 | 46 | 50 | | | | | | | | | | | | | | | | |
| Belgium | | | | | | | | | | | 4 | 4 | 7 | 46 | 7 | 32 | | | | | | | | | | | | | |
| Ireland | | | | | | | | | | | | | | 21 | 36 | 11 | 32 | | | | | | | | | | | | |
| Malta | | | | | | | | | | | | | | 18 | 32 | 39 | 11 | | | | | | | | | | | | |
| EU25 | | | | | | | | | | | | | | 4 | 25 | 14 | 57 | | | | | | | | | | | | |
| Italy | | | | | | | | | | | | | | | | | | 93 | 4 | 4 | | | | | | | | | |
| Greece | | | | | | | | | | | | | | | | | | | 57 | 21 | 21 | | | | | | | | |
| Slovenia | | | | | | | | | | | | | | | | | | 7 | 32 | 36 | 21 | | 4 | | | | | | |
| Czech. Rep. | | | | | | | | | | | | | | | | | | | | 14 | 50 | | 7 | 14 | | 14 | | | |
| Spain | | | | | | | | | | | | | | | | | | | 7 | 7 | 7 | 43 | 21 | 7 | 7 | | | | |
| Portugal | | | | | | | | | | | | | | | | | | | | | | 14 | 50 | 14 | 7 | 14 | | | |
| Lithuania | | | | | | | | | | | | | | | | | | | | | | | 14 | 43 | 36 | 7 | | | |
| Latvia | | | | | | | | | | | | | | | | | | | | 14 | | 25 | 4 | 14 | 21 | 14 | | 7 | |
| Hungary | | | | | | | | | | | | | | | | | | | | 4 | | 18 | | 7 | 18 | 32 | 14 | 7 | |
| Slovakia | | | | | | | | | | | | | | | | | | | | | | | | | 7 | 14 | 57 | 21 | |
| Poland | | | | | | | | | | | | | | | | | | | | | | | | | 4 | 4 | 14 | 79 | |
| Cyprus | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 100 |

*Legend:*
Frequency lower 15%
Frequency between 15 and 30%
Frequency between 30 and 50%
Frequency greater than 50%

## Human resources, skills and creativity (A2)

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Finland | 100 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sweden | | 50 | | 21 | 14 | 7 | 7 | | | | | | | | | | | | | | | | | | | | | | |
| Denmark | | 29 | 29 | 18 | 21 | 4 | | | | | | | | | | | | | | | | | | | | | | | |
| UK | | 21 | 54 | 18 | 7 | | | | | | | | | | | | | | | | | | | | | | | | |
| Japan | | | | 18 | 36 | 43 | 4 | | | | | | | | | | | | | | | | | | | | | | |
| USA | | | 11 | 32 | 21 | 36 | | | | | | | | | | | | | | | | | | | | | | | |
| Netherlands | | | | | | 11 | 71 | 18 | | | | | | | | | | | | | | | | | | | | | |
| Ireland | | | | | | | 18 | 82 | | | | | | | | | | | | | | | | | | | | | |
| France | | | | | | | | | 86 | | 14 | | | | | | | | | | | | | | | | | | |
| Luxembourg | | | | | | | | | 14 | 50 | 21 | | 4 | 4 | | | 7 | | | | | | | | | | | | |
| Belgium | | | | | | | | | | 46 | 54 | | | | | | | | | | | | | | | | | | |
| EU15 | | | | | | | | | | | | 68 | 21 | 11 | | | | | | | | | | | | | | | |
| Austria | | | | | | | | | | 4 | 11 | 18 | 25 | 18 | 25 | | | | | | | | | | | | | | |
| Germany | | | | | | | | | | | | | 14 | 46 | 21 | 18 | | | | | | | | | | | | | |
| EU25 | | | | | | | | | | | | | 29 | 7 | 21 | 32 | 11 | | | | | | | | | | | | |
| Slovenia | | | | | | | | | | | | | 7 | 14 | 14 | 14 | 14 | 29 | 7 | | | | | | | | | | |
| Estonia | | | | | | | | | | | | 14 | | | 14 | 14 | 57 | | | | | | | | | | | | |
| Cyprus | | | | | | | | | | | | | | | | 21 | 7 | 14 | 36 | 14 | 7 | | | | | | | | |
| Lithuania | | | | | | | | | | | | | | | | | | 46 | 43 | 4 | 7 | | | | | | | | |
| Latvia | | | | | | | | | | | | | | | | | | | 7 | 43 | 36 | | 4 | 11 | | | | | |
| Malta | | | | | | | | | | | | | | | | | | | 7 | 36 | 21 | 14 | 21 | | | | | | |
| Spain | | | | | | | | | | | | | | | 4 | | | 7 | | | 21 | 18 | 43 | 7 | | | | | |
| Italy | | | | | | | | | | | | | | | | | | | | | 7 | 64 | 25 | 4 | | | | | |
| Czech. Rep. | | | | | | | | | | | | | | | | | 4 | 4 | | 4 | | 4 | | 64 | 21 | | | | |
| Slovakia | | | | | | | | | | | | | | | | | | | | | | | 7 | 14 | 79 | | | | |
| Poland | | | | | | | | | | | | | | | | | | | | | | | | | | 100 | | | |
| Greece | | | | | | | | | | | | | | | | | | | | | | | | | | | 89 | 11 | |
| Hungary | | | | | | | | | | | | | | | | | | | | | | | | | | | | 64 | 36 |
| Portugal | | | | | | | | | | | | | | | | | | | | | | | | | | | 7 | 29 | 64 |

*Legend:*
Frequency lower 15%
Frequency between 15 and 30%
Frequency between 30 and 50%
Frequency greater than 50%

## Knowledge production and diffusion (A3)

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Finland | ## | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sweden | | 64 | 36 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Japan | | 36 | 64 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USA | | | | ## | | | | | | | | | | | | | | | | | | | | | | | | | |
| Netherlands | | | | | 82 | 18 | | | | | | | | | | | | | | | | | | | | | | | |
| Denmark | | | | | 14 | 64 | 18 | 4 | | | | | | | | | | | | | | | | | | | | | |
| Germany | | | | | | | 43 | 7 | 4 | | 11 | 29 | 7 | | | | | | | | | | | | | | | | |
| Luxembourg | | | | | | | 32 | 46 | 14 | 7 | | | | | | | | | | | | | | | | | | | |
| EU15 | | | | | | | | 36 | 46 | 18 | | | | | | | | | | | | | | | | | | | |
| France | | | | | | 11 | | 4 | | 18 | 29 | 4 | 36 | | | | | | | | | | | | | | | | |
| UK | | | | | | | | | 21 | 18 | 32 | 14 | | 7 | 7 | | | | | | | | | | | | | | |
| Austria | | | | | | | | | | | 25 | 25 | 21 | 29 | | | | | | | | | | | | | | | |
| EU25 | | | | | 4 | | | 4 | 4 | 32 | | 21 | 29 | 7 | | | | | | | | | | | | | | | |
| Malta | | | | | | 7 | 7 | | 11 | 7 | 4 | 7 | 7 | 36 | 14 | | | | | | | | | | | | | | |
| Belgium | | | | | | | | | | | | | | 21 | 79 | | | | | | | | | | | | | | |
| Ireland | | | | | | | | | | | | | | | | 86 | 14 | | | | | | | | | | | | |
| Slovenia | | | | | | | | | | | | | | | | | 71 | 21 | 4 | 4 | | | | | | | | | |
| Cyprus | | | | | | | | | | | | | | | | 14 | 14 | 57 | 7 | 7 | | | | | | | | | |
| Estonia | | | | | | | | | | | | | | | | | | 18 | 75 | 7 | | | | | | | | | |
| Hungary | | | | | | | | | | | | | | | | | | | 7 | 21 | 36 | 11 | 11 | 14 | | | | | |
| Czech. Rep. | | | | | | | | | | | | | | | | | | | | 11 | 14 | 29 | 18 | 29 | | | | | |
| Lithuania | | | | | | | | | | | | | | | | | | 4 | | 25 | 14 | 4 | 11 | 29 | 7 | 7 | | | |
| Latvia | | | | | | | | | | | | | | | | | | | 7 | 7 | 11 | 18 | 11 | 4 | 36 | 7 | | | |
| Italy | | | | | | | | | | | | | | | | | | | | 18 | 11 | 14 | 4 | 7 | | 14 | 29 | 4 | |
| Portugal | | | | | | | | | | | | | | | | | | | | | | 11 | 32 | 18 | 4 | 36 | | | |
| Spain | | | | | | | | | | | | | | | | | | | | | 14 | 14 | 14 | | 18 | 21 | 18 | | |
| Slovakia | | | | | | | | | | | | | | | | | | | | | | | | | 36 | 14 | 43 | 7 | |
| Greece | | | | | | | | | | | | | | | | | | | | | | | | | | | 7 | 46 | 46 |
| Poland | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | 43 | 54 |

*Legend:*

Frequency lower 15%

Frequency between 15 and 30%

Frequency between 30 and 50%

Frequency greater than 50%

## Innovation, entrepreneurship and creative destruction (A4)

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UK | 79 | 21 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Japan | | 43 | 18 | 29 | 7 | 4 | | | | | | | | | | | | | | | | | | | | | | | |
| Slovakia | 7 | 14 | 61 | 18 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sweden | 14 | 21 | 7 | 21 | 36 | | | | | | | | | | | | | | | | | | | | | | | | |
| Luxembourg | | | 11 | 32 | 39 | 18 | | | | | | | | | | | | | | | | | | | | | | | |
| Denmark | | | | | 4 | 50 | 11 | 18 | 11 | | 4 | 4 | | | | | | | | | | | | | | | | | |
| Estonia | | | | | | 7 | 46 | 32 | | | | | | 7 | | | | 7 | | | | | | | | | | | |
| France | | | | | 14 | 18 | 18 | 18 | 29 | 4 | | | | | | | | | | | | | | | | | | | |
| Finland | | | | | | | | | 32 | 21 | | 14 | 11 | 7 | 7 | 4 | | | | | 4 | | | | | | | | |
| Lithuania | | | | | | | 7 | 4 | 14 | 29 | 18 | 14 | 7 | | | | | | 4 | | | 4 | | | | | | | |
| Spain | | | | | | | | | | 4 | 18 | 32 | 18 | 21 | | | 7 | | | | | | | | | | | | |
| Hungary | | | 4 | | | 4 | 11 | 25 | | 4 | | 4 | | | 11 | 4 | 4 | 11 | 4 | 11 | 7 | | | | | | | | |
| Malta | | | | | | | | 4 | | 32 | 7 | 7 | | 11 | 11 | 4 | 14 | 4 | | 4 | | | | | 4 | | | | |
| EU25 | | | | | | | | | 4 | 4 | 4 | 11 | 29 | 11 | 7 | 18 | 7 | | | 7 | | | | | | | | | |
| EU15 | | | | | | | | | | | 32 | 11 | 4 | 14 | 7 | 11 | 14 | 4 | 4 | | | | | | | | | | |
| Ireland | | | | | | | | | | 4 | 11 | | 7 | | 18 | 11 | 14 | 7 | 7 | 7 | 4 | 4 | | 4 | 4 | | | | |
| USA | | | | | | | | | | | | | 14 | 4 | 25 | 14 | 4 | 18 | 7 | | | 4 | 4 | | 4 | 4 | | | |
| Czech. Rep. | | | | | | | | | 7 | | 4 | | | | | 4 | 7 | 29 | 11 | 18 | 14 | 4 | 4 | | | | | | |
| Poland | | | | | | | 7 | | 4 | | | 4 | | 11 | 4 | | 7 | 14 | | 11 | 11 | 7 | 14 | 7 | | | | | |
| Netherlands | | | | | | | | | | | | | 4 | 4 | 7 | | 4 | 4 | 36 | 25 | 11 | 7 | | | | | | | |
| Slovenia | | | | | | | | | | | | | 4 | | | 21 | 11 | | 7 | 11 | 21 | 14 | 7 | 4 | | | | | |
| Belgium | | | | | | | | | | | | | | 7 | | 4 | 4 | | | 4 | 18 | 43 | 7 | | 4 | 11 | | | |
| Latvia | | | | | | | | | | | | | | 4 | 4 | | | | 7 | 7 | | 7 | 29 | 21 | 14 | 7 | | | |
| Greece | | | | | | | | | | | | | | | | | | 4 | 7 | | 4 | | 32 | 43 | 11 | | | | |
| Austria | | | | | | | | | | | 4 | | 4 | | | 7 | | | | | | | | | | 14 | 39 | 32 | | |
| Germany | | | | | | | | | | | | | | | | | | | | | | | | | 4 | 39 | 32 | 11 | 4 | 11 |
| Cyprus | | | | | | | | | | | | | | | | | | | | 4 | 11 | 7 | | 14 | 7 | | 14 | 14 | 29 |
| Portugal | | | | | | | | | | | | | | | | | | | | | | | 4 | 4 | | 7 | 32 | 50 | 4 |
| Italy | | | | | | | | | | | | | | | | | | | | | | | | | | | 11 | 32 | 57 |

*Legend:*

Frequency lower 15%

Frequency between 15 and 30%

Frequency between 30 and 50%

Frequency greater than 50%

## Economic outputs (B1)

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Luxembourg | 71 | 29 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ireland | 29 | 71 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USA | | | ## | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Spain | | | | ## | | | | | | | | | | | | | | | | | | | | | | | | | |
| Greece | | | | | 89 | 7 | 4 | | | | | | | | | | | | | | | | | | | | | | |
| UK | | | | | 4 | 64 | 29 | | 4 | | | | | | | | | | | | | | | | | | | | |
| Japan | | | | | | | 61 | 4 | 25 | 11 | | | | | | | | | | | | | | | | | | | |
| Belgium | | | | | | | | 25 | 36 | 25 | | 14 | | | | | | | | | | | | | | | | | |
| Austria | | | | | | | | 14 | 21 | 14 | 36 | | 4 | 7 | 4 | | | | | | | | | | | | | | |
| Denmark | | | | | | | | 36 | 7 | 14 | 7 | 7 | 29 | | | | | | | | | | | | | | | | |
| Cyprus | | | | | 7 | 25 | 7 | | | 7 | | 7 | | 39 | 7 | | | | | | | | | | | | | | |
| Finland | | | | | | | | | 14 | 14 | 7 | 14 | 4 | 43 | 4 | | | | | | | | | | | | | | |
| Netherlands | | | | | | | | | | | 36 | 50 | 14 | | | | | | | | | | | | | | | | |
| Sweden | | | | | | | | 7 | 7 | | | 36 | 50 | | | | | | | | | | | | | | | | |
| Estonia | | | | | | | | | | | | | | 7 | 79 | 4 | 4 | 4 | 4 | | | | | | | | | | |
| EU15 | | | | | | | | | | | | | | 4 | 7 | 39 | 14 | 21 | 14 | | | | | | | | | | |
| France | | | | | | | | | | | | | | | | 21 | 50 | 14 | | 7 | 4 | 4 | | | | | | | |
| Latvia | | | | | | 4 | | | | | | | | | | 14 | 39 | 29 | 7 | 7 | | | | | | | | | |
| Slovenia | | | | | | | | | | | | | | | | 7 | 7 | 14 | 71 | | | | | | | | | | |
| EU25 | | | | | | | | | | | | | | | | | | 4 | 14 | 82 | | | | | | | | | |
| Germany | | | | | | | | | | | | | | | | | | | 4 | 82 | 14 | | | | | | | | |
| Czech. Rep. | | | | | | | | | | | | | | | | | | | | | | 57 | 7 | 29 | 7 | | | | |
| Italy | | | | | | | | | | | | | | | | | | | | | | 4 | 71 | 25 | | | | | |
| Lithuania | | | | | | | | | | | | | | | | | | | | | | 29 | 14 | 54 | 4 | | | | |
| Portugal | | | | | | | | | | | | | | | | | | | 4 | | | 7 | | | 43 | 43 | | 4 | |
| Slovakia | | | | | | | | | | | | | | | | | | | | | | | | | 46 | 54 | | | |
| Hungary | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | 93 | 4 | |
| Poland | | | | | | | | | | | | | | | | | | | | | | | | | | | 7 | 93 | |
| Malta | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 100 |

*Legend:*

Frequency lower 15%

Frequency between 15 and 30%

Frequency between 30 and 50%

Frequency greater than 50%

## Social performance (B2)

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Denmark | ## | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sweden | | 71 | 29 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Austria | | 25 | 61 | | 14 | | | | | | | | | | | | | | | | | | | | | | | | |
| Netherlands | | | 14 | 71 | 4 | | 7 | 4 | | | | | | | | | | | | | | | | | | | | | |
| USA | | | | 11 | 79 | 7 | | | 4 | | | | | | | | | | | | | | | | | | | | |
| Japan | | | | | | 71 | 14 | 4 | 4 | | | 4 | | | | | | | | 4 | | | | | | | | | |
| Belgium | | | | | | 7 | 75 | 4 | | 11 | 4 | | | | | | | | | | | | | | | | | | |
| Luxembourg | | | | | | | 4 | 46 | 18 | 18 | 7 | 7 | | | | | | | | | | | | | | | | | |
| Cyprus | | | | 4 | 4 | 7 | | 14 | 18 | 18 | 11 | 11 | | 4 | 4 | | 4 | 4 | | | | | | | | | | | |
| Ireland | | | | 4 | 7 | | 4 | 7 | 25 | 18 | 4 | 4 | 11 | 4 | | 4 | | | 7 | | | | 4 | | | | | | |
| EU25 | | | | | | | | 7 | 32 | 7 | 25 | 14 | 7 | 7 | | | | | | | | | | | | | | | |
| Slovenia | | | | 4 | | | 4 | 7 | | 25 | 39 | 21 | | | | | | | | | | | | | | | | | |
| Finland | | | | | | | | | | 11 | 11 | 11 | 54 | 4 | 4 | | 7 | | | | | | | | | | | | |
| UK | | | | | | | | | | | | 7 | 4 | 57 | 14 | 11 | 4 | 4 | | | | | | | | | | | |
| France | | | | | | | | | | | | 14 | | 18 | 36 | 11 | 21 | | | | | | | | | | | | |
| Hungary | | | | | | | | | | | | 4 | 7 | 4 | 36 | 4 | 39 | 7 | | | | | | | | | | | |
| Italy | | | | | | | | | | | | | 18 | | 4 | 43 | | 21 | 7 | | 7 | | | | | | | | |
| Portugal | | | | | | | | | | | | | 4 | | 4 | 21 | 11 | 29 | 18 | 7 | 7 | | | | | | | | |
| Spain | | | | | | | | | | | | | | | | | 7 | 21 | 18 | 21 | 18 | 11 | | 4 | | | | | |
| Malta | | | | | | | | | | | | | | | 4 | | | 4 | 14 | 32 | 32 | 14 | | | | | | | |
| Greece | | | | | | | | | | | | | | | | 7 | 4 | 4 | 14 | 18 | 25 | | | 29 | | | | | |
| Germany | | | | | | | | | | | | | | | | | | | | 4 | | 50 | 46 | | | | | | |
| EU15 | | | | | | | | | | | | | | | | | 4 | 4 | 7 | 7 | 7 | | 29 | 32 | 4 | 7 | | | |
| Latvia | | | | | | | | | | | | | | | | | | 4 | 7 | 14 | 4 | 4 | 29 | 32 | 7 | | | | |
| Czech. Rep. | | | | | | | | | | | | | | | | | | | | | | 4 | 11 | 4 | 82 | | | | |
| Lithuania | | | | | | | | | | | | | | | | | | | | | | | | | 7 | 86 | 7 | | |
| Estonia | | | | | | | | | | | | | | | | | | | | | | | | | | | 50 | 7 | 43 |
| Poland | | | | | | | | | | | | | | | | | | | | | | | | | | | 39 | 61 | |
| Slovakia | | | | | | | | | | | | | | | | | | | | | | | | | | | 11 | 32 | 57 |

*Legend:*

Frequency lower 15%

Frequency between 15 and 30%

Frequency between 30 and 50%

Frequency greater than 50%

**Internationalisation (C1)**

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Luxembourg | 86 | 14 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Belgium | 14 | 64 | 4 | 18 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Austria | | | 32 | 36 | 11 | 14 | | 4 | 4 | | | | | | | | | | | | | | | | | | | | |
| EU15 | | | 25 | 39 | | 14 | 18 | 4 | | | | | | | | | | | | | | | | | | | | | |
| USA | | 7 | 4 | 4 | 43 | 21 | 7 | | 14 | | | | | | | | | | | | | | | | | | | | |
| Cyprus | | | | | 14 | 14 | 32 | 25 | 4 | 4 | 7 | | | | | | | | | | | | | | | | | | |
| UK | | | 18 | 11 | 11 | 7 | 39 | 11 | 4 | | | | | | | | | | | | | | | | | | | | |
| EU25 | | 14 | | 7 | | 18 | 7 | 32 | | 14 | | | 7 | | | | | | | | | | | | | | | | |
| Ireland | | | 4 | | 14 | 11 | 4 | 4 | 21 | | 14 | 14 | 11 | | 4 | | | | | | | | | | | | | | |
| France | | | | | | | | 4 | 25 | 29 | 25 | 11 | 7 | | | | | | | | | | | | | | | | |
| Netherlands | | | | | | | | 18 | 21 | 36 | 21 | | 4 | | | | | | | | | | | | | | | | |
| Denmark | | | | | | | | | | 7 | 29 | 54 | 7 | | 4 | | | | | | | | | | | | | | |
| Sweden | | | | | | | | | | | | 14 | 50 | | | 7 | 21 | | 7 | | | | | | | | | | |
| Czech. Rep. | | | | | | | | | 7 | 11 | 4 | | | 25 | 7 | 25 | 14 | | | 4 | 4 | | | | | | | | |
| Malta | | | | | | | | | | | | | 11 | 14 | 39 | 36 | | | | | | | | | | | | | |
| Spain | | | | | | | | | | | | | | 21 | 25 | 18 | 25 | 11 | | | | | | | | | | | |
| Germany | | | | | | | | | | | | 4 | | 18 | 4 | 7 | 36 | 14 | 7 | 4 | 4 | | 4 | | | | | | |
| Portugal | | | | | | | | | | | | 4 | | 11 | 4 | 4 | 4 | 36 | 11 | 18 | 4 | 7 | | | | | | | |
| Japan | | | | | | | | | | | | | | | 4 | 7 | | 18 | 46 | 25 | | | | | | | | | |
| Slovenia | | | | | | | | | | | | | 4 | 4 | 4 | | | 11 | 21 | 29 | 29 | | | | | | | | |
| Finland | | | | | | | | | | | | | | | | | 4 | 7 | 7 | 14 | 14 | 11 | 11 | 4 | | | 18 | 7 | 4 |
| Hungary | | | | | | | | | | | | | | | | | | | | | 29 | 18 | 25 | 25 | 4 | | | | |
| Poland | | | | | | | | | | | | | | | | | | | | | | 46 | 39 | 7 | 7 | | | | |
| Italy | | | | | | | | | | | | | | | | | | | | | | 18 | 14 | 43 | 25 | | | | |
| Slovakia | | | | | | | | | | | | | | 7 | | | | | 4 | 4 | 21 | | | 18 | 39 | 4 | | 4 | |
| Estonia | | | | | | | | | | | | | | | | | | | | | | | | 4 | 11 | 46 | 32 | 7 | |
| Lithuania | | | | | | | | | | | | | | | | | | | | | | | | | 21 | 50 | 29 | | |
| Latvia | | | | | | | | | | | | | | | | | | | | | | | | | | | 18 | 68 | 14 |
| Greece | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | 14 | 82 |

*Legend:*
Frequency lower 15%
Frequency between 15 and 30%
Frequency between 30 and 50%
Frequency greater than 50%

The overall variation of country positions is synthesised in figure 2, where black marks correspond to the median KEI composite indicator rank and whiskers show best and worst rank occupied by a country considering the whole 2,000 simulations. The internal consistency of KEI conceptual framework is synthesised in Tables 3 and 4, where the relationship between KEI overall ranking and the dimensions and sub-dimensions considered is analyzed by using the Spearman rank correlation coefficients. As a rough first conclusion we could state that overall all dimensions play a role but surely the less influential seems to be the innovation, entrepreneurship and creative destruction dimension. This conclusion is corroborated by a more sophisticated tool i.e. Path Analysis. By using path analysis, the influence of each single dimension on the total ranking can be computed (this influence is divided into a direct effect and an indirect one). Results of the path analysis are presented in table 5. A first conclusion is that all dimensions seem to have a more or less equal impact (the range is between 12 and 18) on the KEI ranking (please note that here only the linear aggregation is used, since path analysis cannot be carried out for the non-compensatory aggregation rule) except dimension A4 (Innovation, entrepreneurship and creative

destruction, whose score is 8). The variability is much higher if one looks at the sub-dimension levels (e.g. very lows scores can be found for knowledge flows (7) or organizational indicators (2)). We can expect an even higher variability at the individual indicator level; this is potentially very relevant if one desires reducing the set of indicators of the KEI conceptual framework. This research issue will be dealt with later on in this report.

**Figure 2. Median and associated 5th and 95th percentiles for the rank distribution**

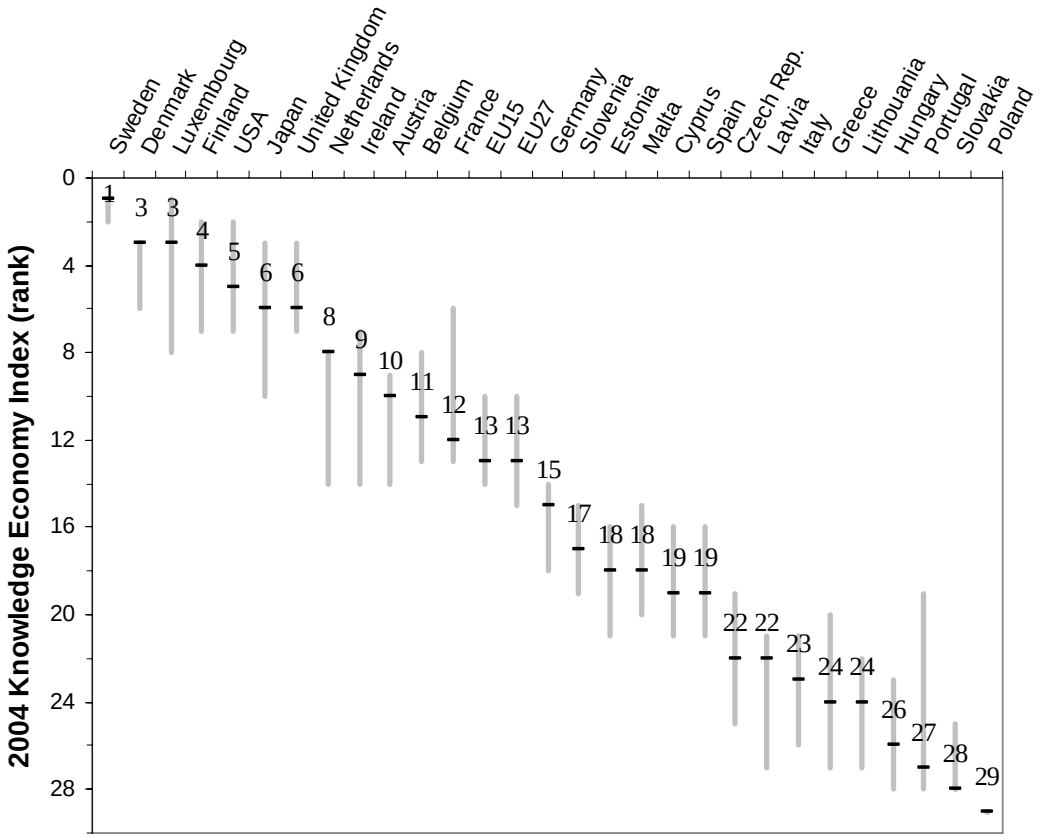


**Table 3: Spearman rank correlation coefficients between KEI and its seven dimensions (median ranks across ~2,000 simulations)**

| | Production and diffusion of ICT | Human resources, skills and creativity | Knowledge production and diffusion | Innovation, entrepreneurship and creative destruction | Economic outputs | Social performance | Internationalisation |
|---|---|---|---|---|---|---|---|
| ***KEI*** | 0.90 | 0.95 | 0.91 | 0.40 | 0.68 | 0.78 | 0.63 |
| **Production and diffusion of ICT** | | 0.87 | 0.88 | 0.42 | 0.54 | 0.58 | 0.41 |
| **Human resources, skills and creativity** | | | 0.90 | 0.44 | 0.60 | 0.68 | 0.53 |
| **Knowledge production and diffusion** | | | | 0.37 | 0.42 | 0.69 | 0.55 |
| **Innovation, entrepreneurship and creative destruction** | | | | | 0.17 | 0.06 | 0.04 |
| **Economic outputs** | | | | | | 0.59 | 0.48 |
| **Social performance** | | | | | | | 0.61 |
| **Internationalisation** | | | | | | | 1.00 |

All coefficients are significant ( $p < 0.05, n = 29$ ).

**Table 4: Spearman rank correlation coefficients between the dimensions and sub-dimensions in KEI (median ranks)**

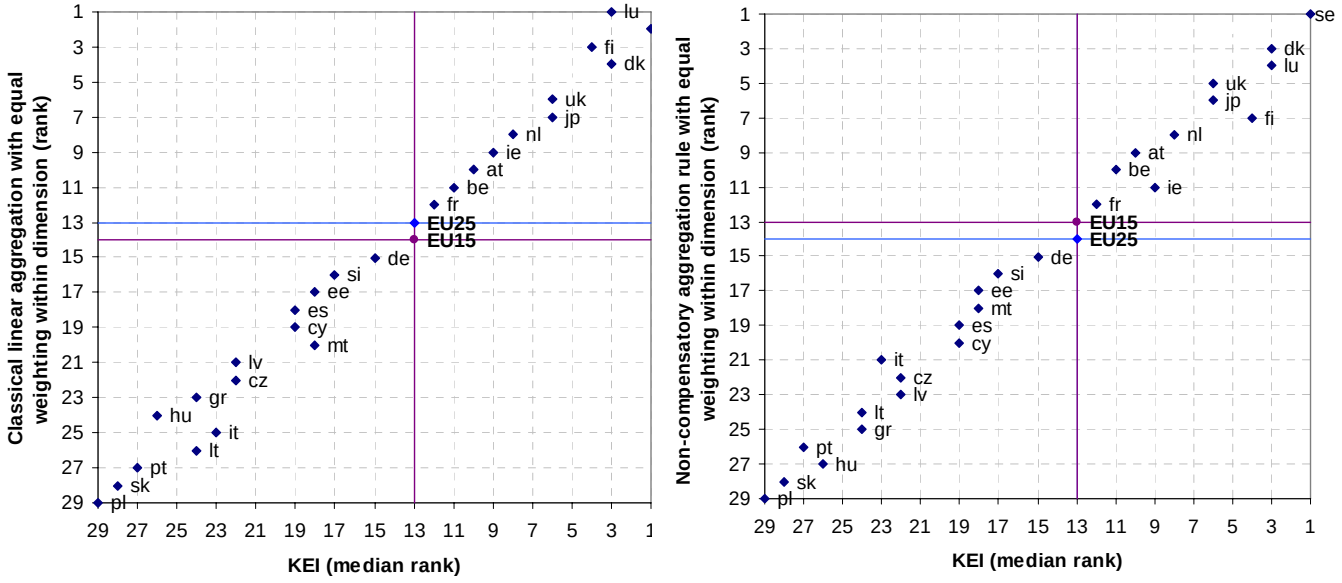
| *A1. Production and diffusion of ICT* | | *A2. Human resources, skills and creativity* | |
|---|---|---|---|
| Economic impact of ICT sector | **0.69** | General education | **0.80** |
| Internet use by firms | **0.84** | Human resource in S&T education | **0.84** |
| Internet use by individuals | **0.91** | Skills | **0.87** |
| Government ICT | **0.84** | Creativity | **0.82** |
| | | Mobility | **0.54** |
| *A3. Knowledge production and diffusion* | | *A4. Innovation, entrepreneurship and creative destruction* | |
| Research and experimental development | **0.88** | Entrepreneurship | **0.37** |
| Patents | **0.95** | Demand for innovative products | **0.63** |
| Bibliometrics | **0.87** | Financing of innovation | **0.41** |
| Knowledge flows | **0.26*** | Market innovation outputs | **0.53** |
| Total investment in intangibles | **0.65** | Organisational indicators | **0.03*** |
| *B1. Economic outputs* | | *B2. Social performance* | |
| Income | **0.66** | Environmental | **0.51** |
| Productivity | **0.75** | Employment and economic welfare | **0.83** |
| Employment | **0.82** | Quality of life indicators | **0.72** |
| *C1. Internationalisation* | | | |
| Trade | **0.59** | | |
| Knowledge production and diffusion | **0.87** | | |
| Economic structure | **0.46** | | |
| Human resources | **0.82** | | |

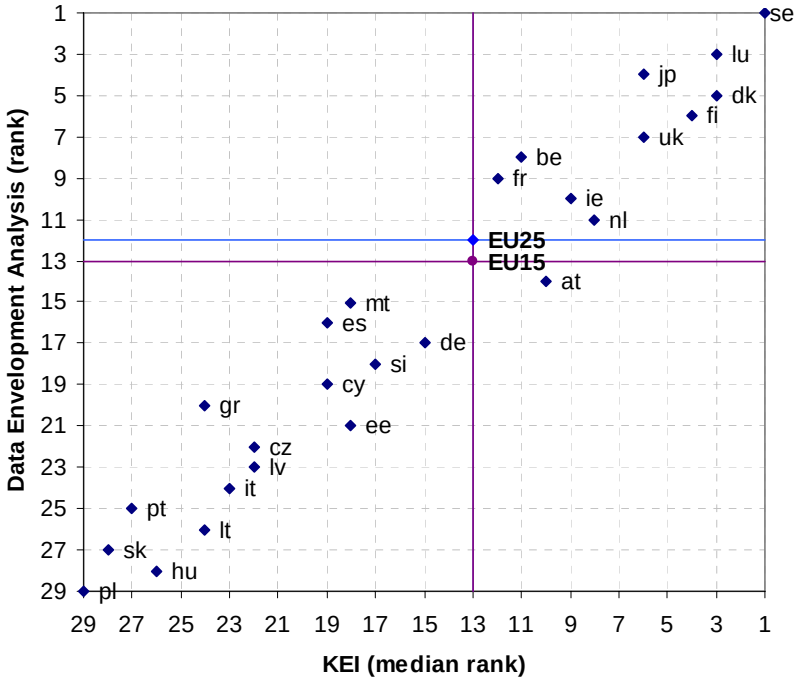
All coefficients are significant ( $p < 0.05, n = 29$ ); * coefficient non significant ($p$ >>0.05).

**Table 5: Path Analysis results: effect of the sub-dimensions and dimensions to KEI (median ranks)**

| Dimensions and sub-dimensions | **Direct and indirect effect (%)** | |
|---|---|---|
| *A1. Production and diffusion of ICT* | | 17 |
| Economic impact of ICT sector | 21 | |
| Internet use by firms | 26 | |
| Internet use by individuals | 28 | |
| Government ICT | 26 | |
| *A2. Human resources, skills and creativity* | | 18 |
| General education | 20 | |
| Human res**ource in S&T** education | 22 | |
| Skills | 22 | |
| Creativity | 21 | |
| Mobility | 14 | |
| *A3. Knowledge production and diffusion* | | 17 |
| Research and experimental development | 24 | |
| Patents | 26 | |
| Bibliometrics | 24 | |
| Knowledge flows | 7 | |
| Total investment in intangibles | 18 | |
| *A4. Innovation, entrepreneurship and creative destruction* | | 8 |
| Entrepreneurship | 18 | |
| Demand for innovative products | 32 | |
| Financing of innovation | 20 | |
| Market innovation outputs | 28 | |
| Organisational indicators | 2 | |
| *B1. Economic outputs* | | 13 |
| Income | 30 | |
| Productivity | 33 | |
| Employment | 37 | |
| *B2. Social performance* | | 15 |
| **Environmental** | 26 | |
| Employment and economic welfare | 40 | |
| Quality of life indicators | 34 | |
| *C1. Internationalisation* | | 12 |
| Trade | 22 | |
| Knowledge production and diffusion | 32 | |
| Economic structure | 17 | |
| Human resources | 30 | |

Let us now look at the comparison between the KEI median ranking and those produced by a particular scenario (selected interesting examples). The rankings derived by a linear aggregation rule and a non-compensatory one (under the equal weighting within dimension assumption) are highly correlated, although the non-compensatory one appears more stable. Compensability might be an issue for Finland whose position in the non-compensatory ranking is definitely worse than the ones of Sweden, Denmark, Luxembourg, United Kingdom and Japan. The bottom countries are very stable in both rankings. Useful information is also coming from the comparison between the KEI median ranking and the ranking derived by using data envelopment analysis weights. Since these weights are beneficial for the bottom countries, we can state quite safely that even with endogenous weights the bottom countries are no doubt very stable, thus they are very far from being knowledge based economy countries. Regarding the top countries, it is noteworthy the strong top position of Sweden and the fact that Finland, even with its best set of weights, is still worse than Luxembourg, Japan and Denmark. A final observation is about Ireland. This country belongs to the set of more or less good performance countries, but it is never a real top countries, even with its best set of weights, we could thus conclude that according to the KEI conceptual framework and its statistical elaboration, the common perception that Finland and Ireland are the most relevant success stories of knowledge based economies is somewhat misleading.




Data Envelopment Analysis (rank)
KEI (median rank)
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29 27 25 23 21 19 17 15 13 11 9 7 5 3 1
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lu
jp
dk
fi
uk
be
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ie
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EU25
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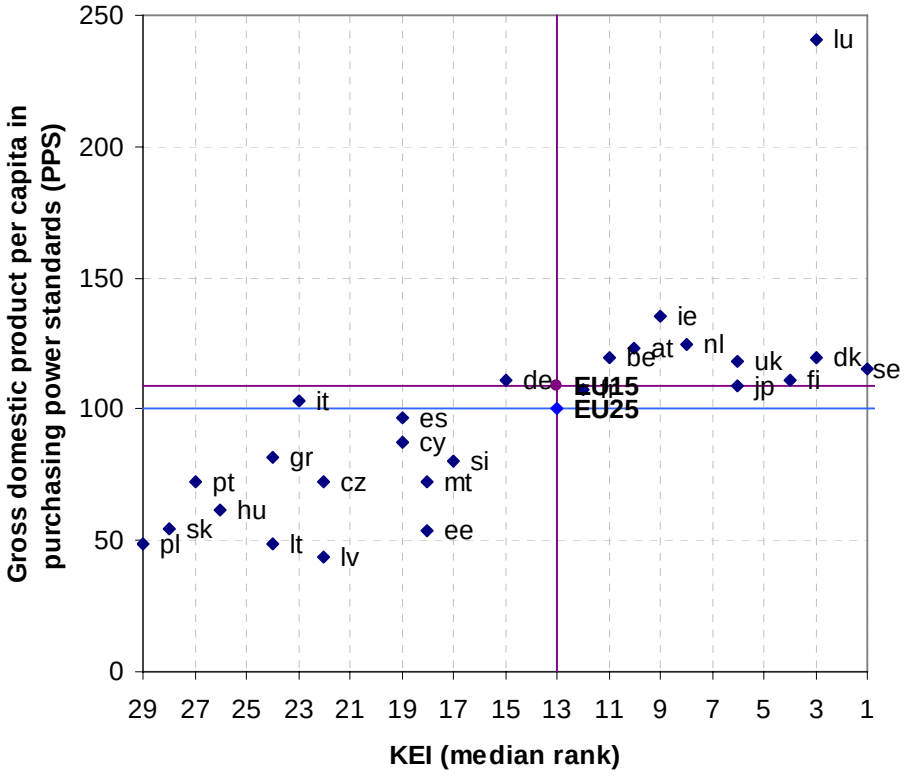
## 3. Relationship between the knowledge economy Index and other complex dimensions

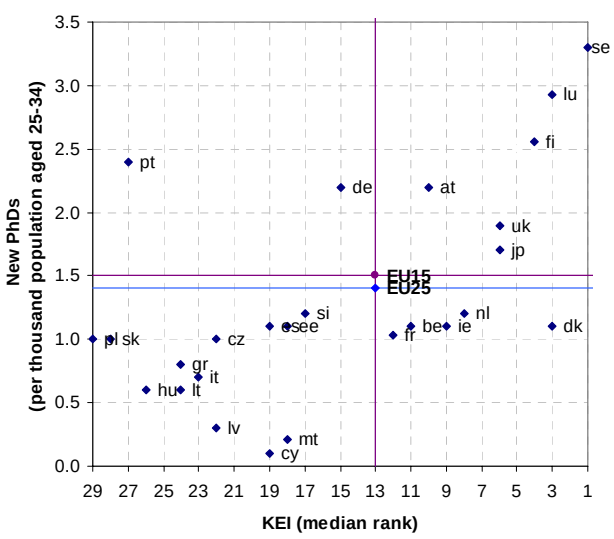
In this Section, we will try to benchmark the KEI composite with some standard economic theory results; this is done by first looking again to KEI conceptual framework and then by comparing KEI median ranking with some other relevant composite indicators. Economic theory tries to take technological change into account by two main theories: *Human capital theory* (whose main foundational principal is the recognition of the role of education and importance of skills people has) and *endogenous growth* (whose main idea is the Schumpeterian concept of accumulation of knowledge due to research and innovation in leading private firms).

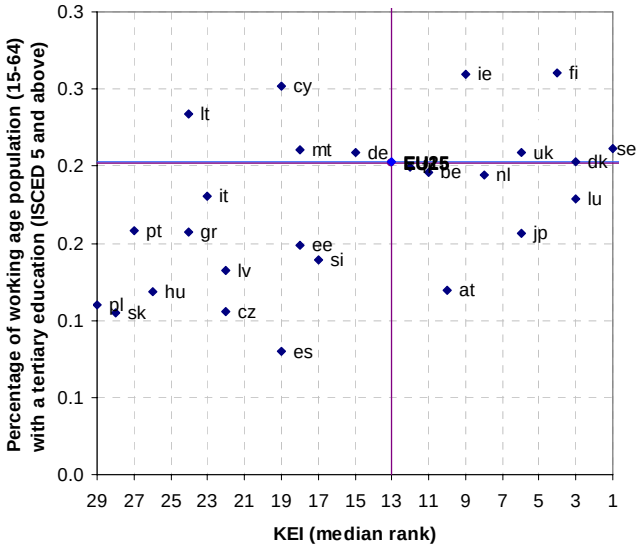
First of all, let us try to understand if to be a knowledge based economy is relevant at all for a good overall economic performance. By looking at the relationship between GDP and the KEI median ranking the answer is YES. Except Germany, Italy and Spain which have a high level of GDP per capita without any particular good performance on a KBE, all the other high level GDP countries seem to perform well in the KEI composite (where Luxembourg can be considered an extreme case -probably an outlier-).

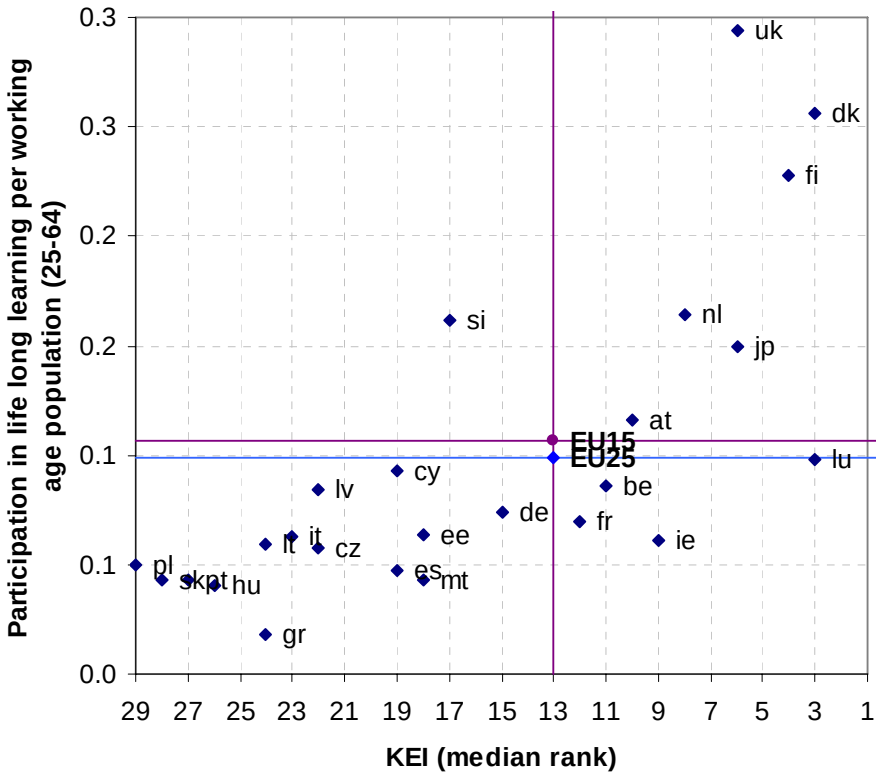


As we already know at the level of dimensions considered in the KEI framework, they all seem to have an influence on the knowledge based economies, thus both economic theories seem to have an influence (since roughly both theoretical models are conceptualised). However, a first result was that the Innovation, entrepreneurship and creative destruction dimension appears not to be very relevant; thus starting challenging the Schumpeterian model. Let us then start by checking if the human capital theory is more relevant in the case of the KEI composite, for doing so we go deeper than the dimensional hierarchical level.

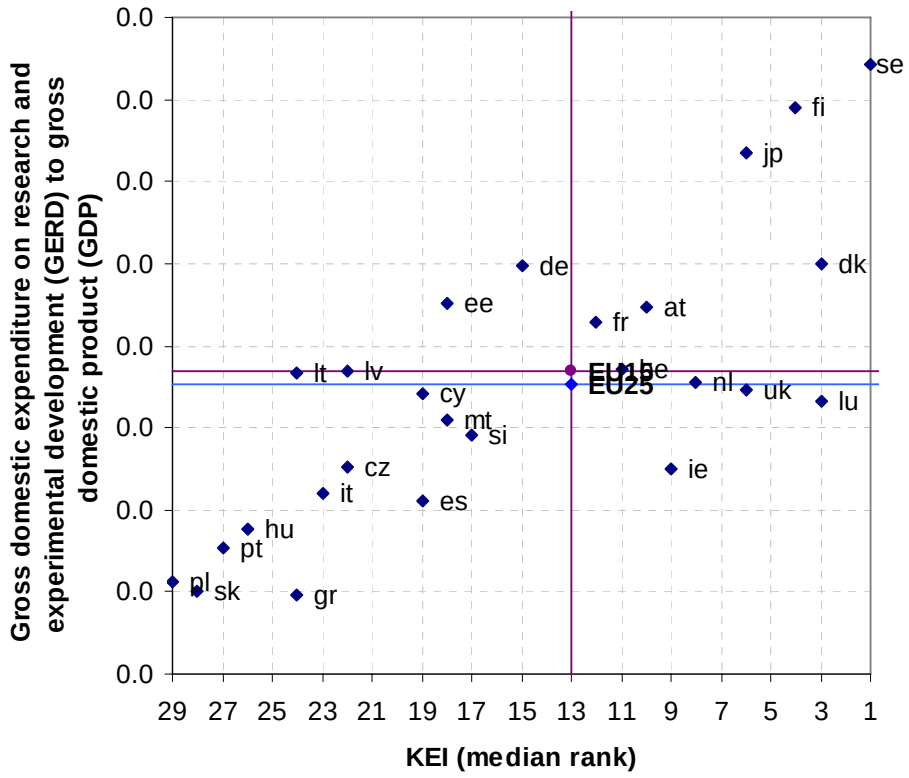
The following conclusions can be drawn from our analysis. While the number of Ph.Ds seems to play a role in explaining the success of a knowledge based economy (all countries with an high number of Ph.Ds, except Portugal, are top countries in the KEI median ranking), the same result does not apply to percentage of working population with a tertiary education (very clear the case of Italy where the number of working population with a tertiary education is extremely high, but the number of Ph.Ds is small). Participation to life long learning seems also to be a success factor, although not for all top countries. In sum, we could state that the human capital theory seems to be corroborated by the KEI results roughly.





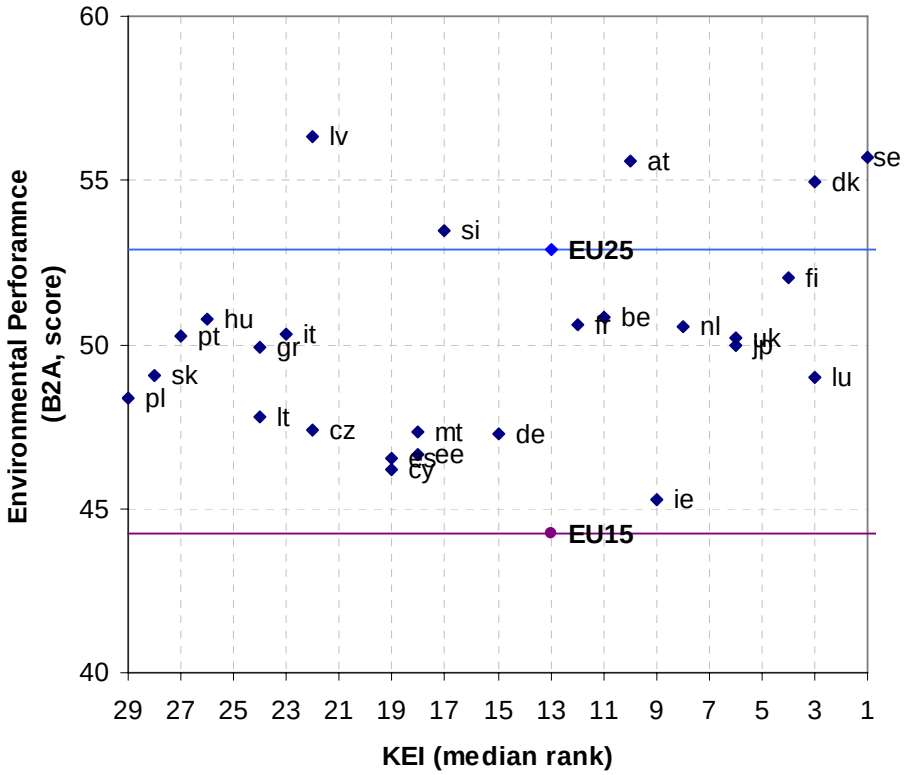

However, if one considers, what probably is the most important Schumpeterian indicator, i.e. Gross domestic expenditure on research and experimental development, the relationship with the KEI median is a clear cut one: countries which invest in research are top countries in a KBE. Research is a key driver for a KBE surely, thus the endogenous growth idea seems also corroborated.




Let us now look at other concepts embedded in the idea of a knowledge economy. A popular one is *eco-efficiency*. i.e. the idea that advanced economies, such as knowledge based economies, are more environmental friendly since they use less material goods and are more energy efficient in productive activities. Unfortunately, the *Jevons' paradox*[1] teaches us that an increase in efficiency in using a resource leads, in the medium to long term, to an increased consumption of that resource (rather than a decrease). This is a classic example of the co-existence of opposite causal links emerging when considering the same process at different (spatial, temporal) scales. Trade-offs also emerge when considering different attributes of performance or when adopting different disciplinary analyses. Sustainability literature clearly emphasizes that environmental preservation has an economic cost and

[1] In 1865, William Stanley Jevons wrote an influential book, entitled *The Coal Question; An Inquiry Concerning the Progress of the Nation, and the Probable Exhaustion of Our Coal Mines* (London: Macmillan & Co). In Chapter seven, entitled 'Of the economy of fuel", Jevons observed that the consumption of coal rose rapidly after James Watt had introduced his coal-fired steam engine, which much improved the efficiency of Thomas Newcomen's earlier designs. Watt's innovations made coal a more efficient source of power, leading to an increased use of the steam engine in a wider range of industries. This in turn increased total coal consumption, even though the amount of coal required for any particular application dropped through efficiency gains. Thus in general, technological efficiency will not result in the liberation from environmental damage as it has been promised. For a recent discussion on the Jevons' paradox sees John M. Polimenia and Raluca Iorgulescu Polimeni – Jevons's paradox and the myth of technological liberation, Ecological Complexity Volume 3, Issue 4, December 2006, Pages 344-353.

economic growth has an environmental cost, no escapes from this conflict exists[2]. These arguments seem corroborated by the KEI measure. In fact, as one can see, no clear relationship between environmental performance and a KBE exists.

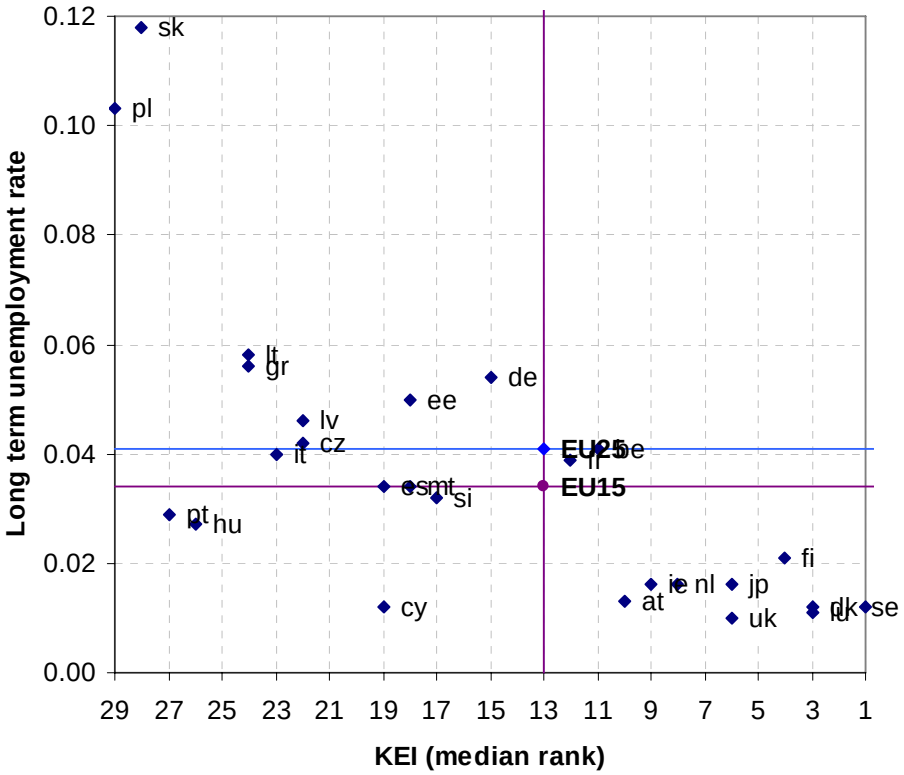



Another interesting aspect of a KBE is unemployment. Job creation can be successfully increased in the short term, by a slowdown of the rate of technological progress. As noted by the Kok report[3], this is exactly what has recently happened inside the European Union. But in a longer time horizon, this strategy may easily cause the collapse of the economy given that non-specialized low productivity jobs can easily be substituted by lower wage labour in other parts of the world. Thus, in the short term technological progress and job creation are conflicting objectives but they might be compatible in the long period if a right balance (i.e. compromise) between flexibility and employment security is found. If the relationship between long term unemployment rate and the KEI median ranking is displayed, this

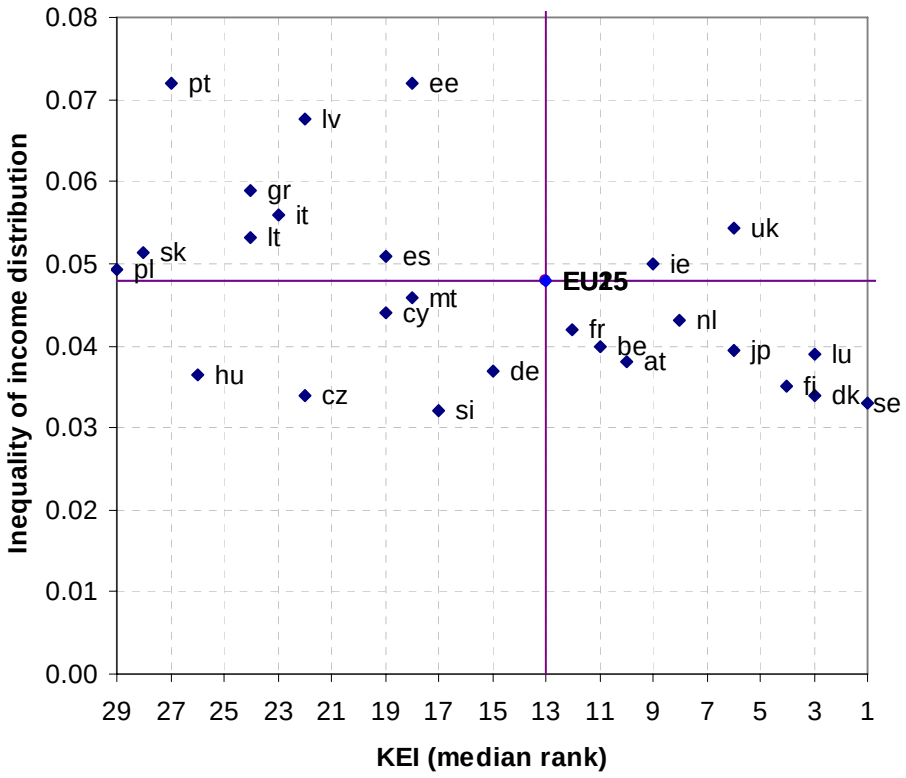
[2] The so-called "environmental Kuznets curve" assumption states that when GDP grows, initially the environmental impact is also bigger, but when prosperity is sufficiently high, the environmental impact decreases very much. According to this theoretical framework economic growth and environmental preservation are not necessarily in conflict. However, the truth of this assumption depends on the type of environmental impact considered. For example, for SO2 or for urban smoke concentration it always applies, but if one considers carbon dioxide emissions, total energy consumption or urban waste the empirical relation with GDP goes always in the same direction, thus GDP growth in this cases, implies much more environmental impact.

[3]Kok W. (2004,) - The High Level Group on Lisbon Strategy (chaired by Wim Kok) (2004) – Facing the Challenge, European Communities, Luxembourg.

compatibility between technological progress and job creation seems to be true. All top countries in the KEI measure are presenting an extremely low long term unemployment rate. This aspect of a KBE seems extremely interesting and encouraging.

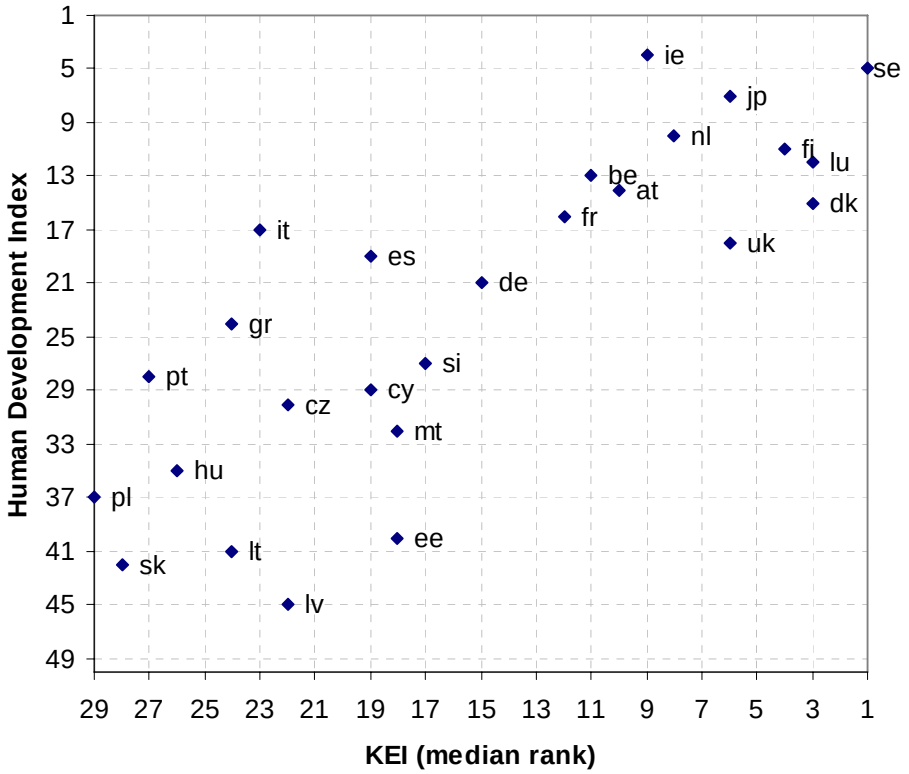



Another common statement about a KBE is that income distribution inequalities are reduced. This statement appears difficult to corroborate by examining the relationship between the KEI measure and the income distribution inequality. No precise relationship exists and when it seems to exist, in reality might simply be a corroboration of the classical Kuznets curve model, where income distribution inequality is supposed to decrease when GDP increases (one should not forget that KEI and GDP are correlated).




As an external benchmark, we look at the relationship between the KEI composite and the Human Development Index. The relationship found seems again a corroboration of the human capital theories, in fact the correlation between KEI and the HDI is extremely high. A peculiar behaviour is the one of Italy and Spain whose HDI is high but the KEI performance is poor.

In this context a relevant index to use as a final external benchmark might be the Active Citizenship Index. This index produced at JRC by CRELL (Centre for Research on Lifelong Learning) is an attempt to measure a component of the social capital, and thus can be considered as complementary to the human capital measurements, which look more at individual skills. It is interesting to note that this index correlates very much with the KEI median ranking, thus it might open interesting research questions on the importance of the social component in a knowledge based economy.


Human Development Index
KEI (median rank)
1
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49
29 27 25 23 21 19 17 15 13 11 9 7 5 3 1
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se
jp
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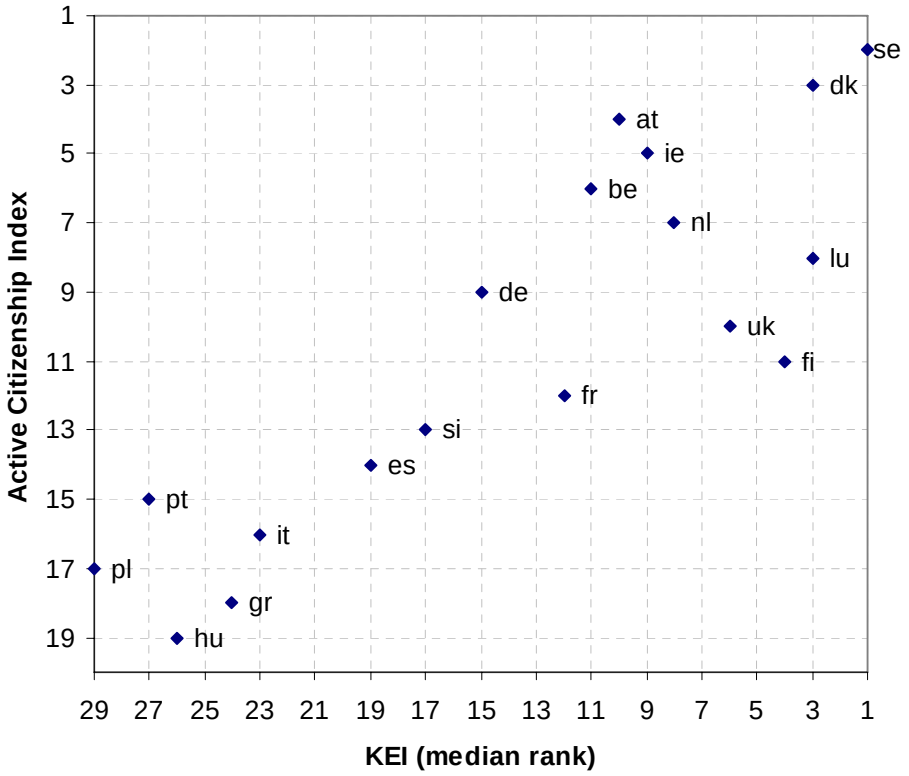
Active Citizenship Index
KEI (median rank)
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19
29 27 25 23 21 19 17 15 13 11 9 7 5 3 1
se
dk
at
ie
be
nl
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de
uk
fi
fr
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# 4. Is it possible to reduce the total number of individual indicators of KEI conceptual framework without loosing any relevant information?

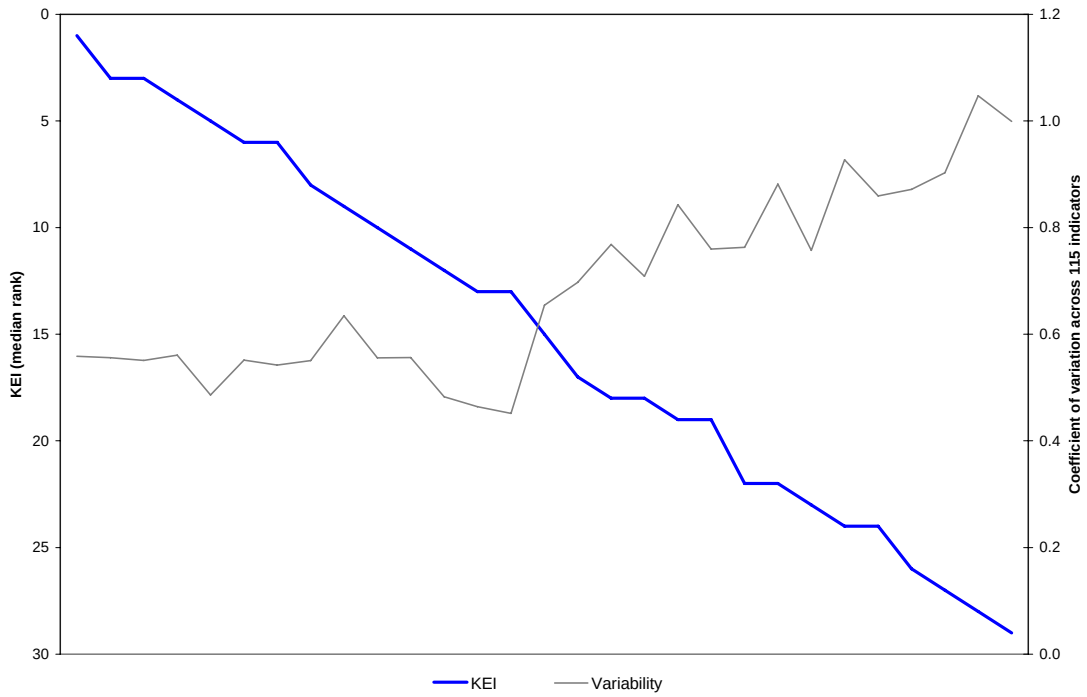
Let us discuss the relationship between the KEI median rank and the variability in the set of 115 underlying indicators composing the Knowledge Economy Index. The variability is expressed here by means of the coefficient of variation that is calculated as the ratio of the standard deviation to the mean of the 115 indicators' values per country. The indicators are scaled using the Min-max approach for the purposes of this analysis only and with a view to avoid an eventual underestimation of the variability, for example, if the standardisation method had been used. Note that in a more general case one would study the composite indicator scores versus the variability in the underlying indicators. In our case, the KEI results focus on the country ranks, so as to accommodate for the non-linear/non-compensatory multi-criteria analysis.

Figure 3 shows that the variability increases as we move towards the bottom-ranked countries. In fact, countries ranked between 1$^{st}$ and 15$^{th}$ position in the overall KEI tend to score uniformly high in the majority of the underlying indicators, as shown by the relatively low coefficient of variation (lower than 0.6) across the indicators values. On the other hand, countries ranked after the 16$^{th}$ position have a variability value greater than 0.6 up to 1.0 or slightly higher. A scissors pattern is evident. The correlation coefficient between the KEI median rank (opposite sign) and the coefficient of variation series is equal to $r = -0.878$, indicating *a strong degree of reverse association between the KEI ranks and the variability in the underlying indicators*. For comparison purposes, in the case of the Trade and Development Index (UNCTD, 2005) that was based on eleven components and developed for 110 countries, the correlation coefficient between the index scores and the coefficients of variation series was also high ($r = -0.93$).

An implication of this finding is that while changes in the KEI ranks over time could be regarded as a quantitative indication of trends in knowledge economy in Europe and in the USA and Japan, those in respect of the variability could be seen as qualitative changes. Reducing even further the variability in the indicators should be among the objectives of policies and strategies for a knowledge economy. To be successful, a country must put simultaneous thrust on multiple goals within a coherent knowledge economy strategy, while emphasizing reduction of the existing gaps in areas where performance is lagging. As the

exceptional behaviour of a few countries that have very low overall KEI performance but very high performance in just few of the sub-dimensions, a disproportionate emphasis on a limited number of objectives without concomitant focus on many of the determinants of knowledge economy can yield only marginal results.

**Figure 3. The scissor diagram of KEI and variability**




At a next step, we aim to reduce the attention from the suite of the 115 underlying indicators to a more parsimonious list, so as to present the country profiles and give some indication of the key indicators for the knowledge economy. We are not arguing in favour of using this reduced list of indicators to develop another version of the KEI. The approach undertaken here is guided by the need to present the country profiles.

To this end, we first undertook both forward and backward stepwise regression, so as to identify those indicators within a KEI dimension that represent (in a linear fashion) the dimension. We also applied forward/stepwise regression to choose those indicators that represent best the overall KEI rank. We finally crosschecked, using canonical analysis, whether the subset of indicators describes reliably the set of the seven KEI dimensions and the overall KEI. Results are shown in Table 6, where the 23 indicators (from a total of 115) are proven sufficient to describe 97.4% of the variation in the overall set (KEI and its seven dimensions).

**Table 6. Reduced set of indicators on the knowledge economy to serve for the country profiling needs**

| |
|---|
| **Production and diffusion of ICT (A1)** |
| ICT value-added (% of total business sector value added) |
| SMEs ordering over the Internet (% of total SMEs) |
| Individuals using the internet for banking (% total) |
| **Human resources, skills and creativity (A2)** |
| Pisa reading literacy of 15y (average score) |
| Total researchers (per 1000 labour force in FTE) |
| Participation in lifelong learning (% of working 25-64y) |
| Employed in creative occupations (% total) |
| **Knowledge production and diffusion (A3)** |
| BERD performed in service industries (%) |
| EPO high tech patent applications (per million pop.) |
| Triadic patent families (per million pop.) |
| **Innovation, entrepreneurship and creative production (A4)** |
| Firm entries (birth rate) |
| GDP (per capita) |
| Early-stage venture capital ( % GDP) |
| SMEs reporting non technological change (%) |
| **Economic outputs (B1)** |
| GDP per capita (in PPS) |
| Real GDP growth rate |
| Total employment growth |
| **Social performance (B2)** |
| Long term unemployment rate |
| Hampered in daily activities because of chronic conditions |
| Rooms per person by tenure status and type of housing |
| **Internationalisation (C1)** |
| Technology balance of payments (% GERD) |
| Co authorship share on international S&E articles |
| Foreign PhD students (% total PhD enrolment) |

# 5. Are rankings useful at all for deriving policy suggestions?

A nasty question at this point might be: *is all this effort we have done of any use?* Even if we have very reliable rankings, which is the policy utility of knowing that a country is overall better than another one or vice versa? This kind of criticism is often put to composite indicators, thus it is worthy to tackle this issue.

Indeed we have already seen that rankings are already giving very interesting information for policy purposes. For example, in the KEI framework, we succeeded to find out clear success stories, i.e. top performance countries, and clear policy drivers. However, one should note that for the majority of indicators used in any assessment exercises no clear reference point is available, for instance, when GDP is used nobody knows the ideal value of a Country GDP, thus it is quite common to compare with other Countries GDP, e.g. the USA one. In general to get a set of reference values to be used as benchmarks, two options exist:

- To compare any country performance with a relevant average (in our case EU15 or EU25).
- To construct an "ideal point" defined by choosing the best values reached in any single individual indicator by a country. This is a well established technique in multi-criteria evaluation literature and has the advantage of indicating "real world ideal values".

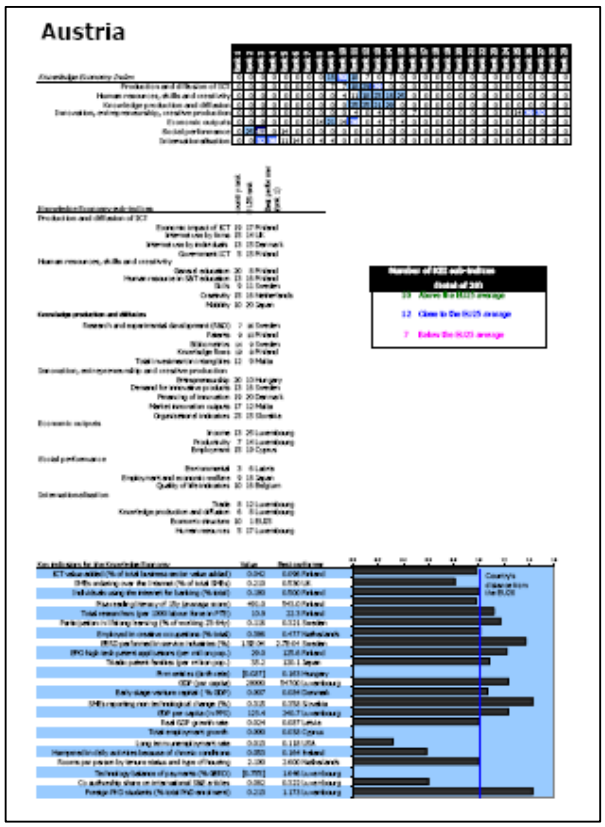
Here we follow both approaches. We will first synthesise the performance of each single country by comparing its scores on dimensions and sub-dimensions with the EU25 average. Later on country profiles are shown in details, where both EU25 average and the idea of a best performing country are used for deriving policy priorities.

By looking at the following Table, we have both synthetic and analytic information on single country performance. In fact we know the total numbers of sub-dimensions which are above (+), close (0) or below (-) the EU25 average, thus allowing a quick scoring of countries; but at the same time, it is also possible to derive policy suggestions since all the sub-dimensions are scored. To give some illustrative examples, Finland is clearly a top performing country since it is above or close to the EU25 average for the majority of sub-dimensions. The only plausible policy priorities since the performance is below the average are Entrepreneurship, Organizational indicators, Knowledge production and diffusion and Economic Structure.

Entrepreneurship, Organizational indicators and Economic Structure seem problematic for another top performing country, Sweden. For Sweden, Mobility and Knowledge flows also offer space for improvement. On the other side, if one examines the performance of countries such as Italy (above in the average only in Government ICT and Organizational indicators), Portugal (+ only in Financing of innovation and employment and economic welfare) or Greece (+ only in Economic impact of ICT, Income and Employment) it is clear that the space for improvement is enormous, but of course this does not necessarily mean that their governments wish to pursue the objective of being a KBE, it is important to remember that a KBE is one of the possible models that a country may choose and the fact that a poor performance exists might simply mean that this scope is not a policy objective for that country. An interesting result is that EU 15 is NOT always equal or superior to the average of EU25. It is actually below EU25 average in three sub-dimensions: Organizational indicators, Environment and Economic structure; in these areas the enlargement has then lead to an improvement of the average EU performance.

| Dimension | Sub-dimension | AT | BE | CY | CZ | DE | DK | EE | ES | EU15 | FI | FR | GR | HU | IE | IT | JP | LT | LU | LV | MT | NL | PL | PT | SE | SI | SK | UK | USA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production and diffusion of ICT | Economic impact of ICT | 0 | 0 | - | 0 | 0 | + | + | - | 0 | + | 0 | + | 0 | + | 0 | + | - | 0 | + | - | + | - | - | + | - | - | + | + |
| | Internet use by firms | 0 | 0 | - | - | + | + | - | - | 0 | + | + | - | - | + | - | + | - | 0 | - | + | 0 | - | - | + | 0 | - | + | + |
| | Internet use by individuals | 0 | 0 | - | - | + | + | + | - | + | + | + | - | - | - | - | + | - | + | - | - | + | - | - | + | - | - | + | + |
| | Government ICT | + | 0 | - | - | 0 | + | + | 0 | 0 | + | + | - | - | 0 | + | + | - | + | - | 0 | 0 | - | - | + | - | - | - | + |
| Human resources, skills and creativity | General education | - | 0 | 0 | - | 0 | - | - | - | 0 | + | 0 | - | - | + | - | - | 0 | - | - | - | 0 | - | - | + | - | - | 0 | 0 |
| | Human resource in S%T education | 0 | 0 | 0 | - | 0 | + | + | 0 | 0 | + | + | - | - | + | - | + | 0 | + | 0 | - | - | - | - | + | - | 0 | 0 | + |
| | Skills | 0 | 0 | 0 | - | - | + | - | - | 0 | + | - | - | - | - | - | + | - | 0 | 0 | - | + | - | - | + | + | - | + | + |
| | Creativity | 0 | + | - | 0 | + | + | 0 | - | 0 | + | 0 | - | - | + | 0 | + | - | + | - | - | + | - | - | + | - | - | + | + |
| | Mobility | + | 0 | + | - | 0 | + | + | + | 0 | + | + | 0 | - | + | - | + | + | - | + | 0 | + | - | 0 | - | + | - | + | + |
| Knowledge production and diffusion | R&D | + | 0 | + | - | + | + | 0 | - | 0 | + | + | - | - | - | - | + | 0 | 0 | 0 | 0 | 0 | - | - | + | 0 | - | 0 | + |
| | Patents | + | 0 | 0 | - | + | + | - | - | 0 | + | 0 | - | - | - | - | + | - | + | - | - | + | - | - | + | - | - | 0 | + |
| | Bibliometrics | - | 0 | - | - | 0 | + | - | - | 0 | + | 0 | - | - | - | - | + | - | - | - | 0 | + | - | - | + | - | - | + | + |
| | Knowledge flows | - | - | - | - | - | - | - | - | 0 | + | - | - | - | - | - | 0 | - | - | + | - | - | - | 0 | 0 | + | + | - | - |
| | Total investment in intangibles | - | - | 0 | - | - | - | - | - | 0 | 0 | 0 | - | + | + | - | + | - | + | - | + | 0 | - | - | - | - | - | + | + |
| Innovation, enterpreunership and ctreative diffusion | Entrepreneurship | - | 0 | - | - | + | - | 0 | 0 | 0 | - | 0 | - | + | - | - | 0 | 0 | 0 | 0 | - | - | 0 | - | - | - | 0 | + | - |
| | Demand for innovative products | 0 | - | 0 | 0 | 0 | + | + | 0 | 0 | 0 | 0 | 0 | 0 | + | - | 0 | 0 | + | 0 | - | 0 | - | - | + | 0 | + | + | 0 |
| | Financing of innovation | 0 | + | + | - | + | + | + | 0 | + | + | + | 0 | - | + | 0 | + | + | + | + | 0 | 0 | - | + | + | 0 | 0 | + | + |
| | Market innovation outputs | 0 | - | - | 0 | - | 0 | 0 | - | 0 | 0 | - | 0 | - | 0 | - | + | - | + | - | + | 0 | - | - | 0 | + | 0 | + | 0 |
| | Organisational indicators | - | - | 0 | + | - | - | - | + | - | - | + | 0 | + | - | + | 0 | + | - | 0 | + | + | + | 0 | - | + | + | - | - |
| Economic outputs | Income | + | + | + | 0 | 0 | 0 | + | 0 | 0 | + | 0 | + | 0 | + | - | 0 | + | + | + | - | 0 | 0 | - | + | + | 0 | + | + |
| | Productivity | + | + | - | - | 0 | 0 | 0 | + | 0 | 0 | + | 0 | - | + | 0 | + | - | + | - | - | 0 | - | - | 0 | 0 | - | 0 | + |
| | Employment | 0 | - | + | 0 | 0 | + | - | + | 0 | + | - | + | - | + | - | + | - | + | 0 | - | 0 | - | 0 | + | 0 | - | + | + |
| Social performance | Environmental | + | 0 | - | - | - | 0 | - | - | - | 0 | 0 | - | 0 | - | 0 | - | - | - | + | - | 0 | - | - | + | 0 | - | - | 0 |
| | Employment and economic welfare | + | 0 | + | 0 | 0 | + | - | 0 | 0 | 0 | 0 | - | + | + | 0 | + | - | + | 0 | + | + | - | + | + | + | - | + | + |
| | Quality of life indicators | + | + | + | - | 0 | + | - | + | 0 | 0 | 0 | 0 | - | + | 0 | 0 | - | + | - | 0 | + | - | - | + | - | - | - | + |
| Internationalisation | Trade | 0 | + | 0 | 0 | 0 | 0 | - | 0 | 0 | + | 0 | - | 0 | + | 0 | 0 | - | + | - | 0 | + | 0 | - | + | 0 | 0 | 0 | 0 |
| | Knowledge production and diffusion | 0 | + | 0 | - | - | - | - | 0 | + | - | 0 | - | - | 0 | - | - | - | + | - | 0 | 0 | - | - | 0 | - | - | + | 0 |
| | Economic structure | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Human resources | + | + | + | 0 | + | + | - | 0 | 0 | 0 | + | 0 | - | + | - | + | - | + | - | 0 | + | - | 0 | 0 | - | - | + | + |
| Number of sub-dimensions | **Above the EU25** | 10 | 8 | 8 | 1 | 8 | 17 | 8 | 5 | 3 | 17 | 10 | 3 | 4 | 16 | 2 | 18 | 4 | 17 | 6 | 5 | 12 | 1 | 2 | 19 | 7 | 3 | 17 | 19 |
| | **Close to the EU25** | 12 | 14 | 9 | 9 | 13 | 5 | 5 | 10 | 23 | 8 | 14 | 8 | 5 | 3 | 8 | 7 | 5 | 5 | 8 | 9 | 13 | 3 | 5 | 5 | 8 | 6 | 6 | 6 |
| | **Below the EU25** | 7 | 7 | 12 | 19 | 8 | 7 | 16 | 14 | 3 | 4 | 5 | 18 | 20 | 10 | 19 | 4 | 20 | 7 | 15 | 15 | 4 | 25 | 22 | 5 | 14 | 20 | 6 | 4 |

To understand the country profiles presented, the following explanations are useful.




The Country Profiles present a compilation of selected data and statistics for each individual country included in the *Knowledge Economy Index*. The European Union countries included are: Austria, Belgium, Cyprus, Czech. Rep., Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden and United Kingdom. The EU15 and EU25 are also included. Finally, two non-European countries are used for benchmarking purposes: Japan and the United States of America.

**❶ Knowledge Economy Index (KEI) and its seven main dimensions**

The first section presents the frequency distribution (%) of a country's rank in KEI and in each of the seven dimensions (Production and diffusion of ICT; Human resources, skills and creativity, etc.). These frequencies are estimated over ~2000 scenarios in the development of the KEI depending on:

a. imputation method (dataset deriving from either splines or multiple imputation),
b. number of sub-dimensions (all 29 sub-dimensions included or one-at-time excluded)
c. number of dimensions (all seven dimensions included or one-at-time excluded)
d. normalisation of the 29 sub-dimensions scores (z-scores or min-max),
e. structure relating the sub-dimensions to the dimensions (preserved or not),
f. weighting method (factor analysis, equal weighting, data envelopment analysis),
g. aggregation rule (additive, multiplicative, non-compensatory multi-criteria analysis).

For example, Austria has a frequency value 50 under rank 10, which implies that Austria was ranked 10$^{th}$ (total of 29 positions) in the KEI in 50% of the scenarios. A colour code summarizes the frequencies as follows:

| |
|---|
| Frequency lower 15% |
| Frequency between 15 and 30% |
| Frequency between 30 and 50% |
| Frequency greater than 50% |

**❷ Knowledge Economy Index sub-indices**

The second section presents the country rank in each of the 29 sub-indices (grouped under the seven main dimensions). For comparative purposes, the EU25 rank and the best performing country in each sub-dimension are also shown. A summary table provides the number of sub-dimensions that are above, close to, or below the EU25 score. A country's

performance was deemed to be close to the EU25 performance if the country score is in the range $\left[90\% \cdot EU25_{score}, 110\% \cdot EU25_{score}\right]$.

### ❸ Key indicators for the Knowledge Economy

The third section offers the raw data values for a country across 23 indicators, which were selected from the dataset of 115 indicators underlying the Knowledge Economy Index. The 23 indicators were originally grouped (together with the rest 92 indicators) under the seven main dimensions as follows:

**Production and diffusion of ICT**:
ICT value-added (% of total business sector value added); SMEs ordering over the Internet (% of total SMEs); Individuals using the internet for banking (% total)

**Human Resources, skills and creativity**:
Pisa reading literacy of 15y (average score); Total researchers (per 1000 labour force in FTE); Participation in lifelong learning (% of working 25-64y); Employed in creative occupations (% total)

**Knowledge production and diffusion**:
BERD performed in service industries (%); EPO high tech patent applications (per million pop.); Triadic patent families (per million pop.)

**Innovation, entrepreneurship, creative production**:
Firm entries (birth rate); GDP (per capita); Early-stage venture capital ( % GDP); SMEs reporting non technological change (%)

**Economic outputs**:
GDP per capita (in PPS); Real GDP growth rate; Total employment growth

**Social performance**:
Long term unemployment rate; Hampered in daily activities because of chronic conditions; Rooms per person by tenure status and type of housing

**Internationalisation**:
Technology balance of payments (% GERD); Co authorship share on international S&E articles; Foreign PhD students (% total PhD enrolment)

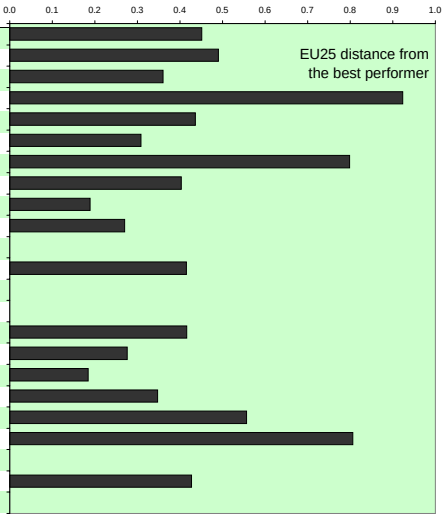
In case a country missed data for a given indicator, the missing datum was estimated by multiple imputation. Estimates are included in brackets and report the mean value based on the multiple imputation. For comparative purposes, the best performing country and score are shown. A graph complements the information provided in this section by displaying the relative distance of the country score from the respective EU25 value. Estimated values are not displayed in the graph. For the EU25 profile, this last graph shows the distance of the EU25 from the best performing country in the KEI dataset.

# EU25

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 14 | 32 | 39 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 25 | 14 | 57 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 7 | 21 | 32 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 4 | 4 | 32 | 0 | 21 | 29 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 4 | 11 | 29 | 11 | 7 | 18 | 7 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 14 | 82 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social performance** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 32 | 7 | 25 | 14 | 7 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 0 | 14 | 0 | 7 | 0 | 18 | 7 | 32 | 0 | 14 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Knowledge Economy sub-indices** | EU25 rank | Best performer (rank 1) |
|---|---|---|
| **Production and diffusion of ICT** | | |
| Economic impact of ICT | 17 | Finland |
| Internet use by firms | 14 | UK |
| Internet use by individuals | 15 | Denmark |
| Government ICT | 15 | Finland |
| **Human resources, skills and creativity** | | |
| General education | 8 | Finland |
| Human resource in S&T education | 16 | Finland |
| Skills | 11 | Sweden |
| Creativity | 16 | Netherlands |
| Mobility | 20 | Japan |
| **Knowledge production and diffusion** | | |
| Research and experimental development (R&D) | 16 | Sweden |
| Patents | 13 | Finland |
| Bibliometrics | 9 | Sweden |
| Knowledge flows | 8 | Finland |
| Total investment in intangibles | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | |
| Entrepreneurship | 10 | Hungary |
| Demand for innovative products | 16 | Sweden |
| Financing of innovation | 20 | Denmark |
| Market innovation outputs | 12 | Malta |
| Organisational indicators | 15 | Slovakia |
| **Economic outputs** | | |
| Income | 25 | Luxembourg |
| Productivity | 14 | Luxembourg |
| Employment | 19 | Cyprus |
| **Social performance** | | |
| Environmental | 6 | Latvia |
| Employment and economic welfare | 18 | Japan |
| Quality of life indicators | 16 | Belgium |
| **Internationalisation** | | |
| Trade | 12 | Luxembourg |
| Knowledge production and diffusion | 8 | Luxembourg |
| Economic structure | 1 | EU25 |
| Human resources | 17 | Luxembourg |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.043 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.260 | 0.530 | UK |
| Individuals using the internet for banking (% total) | 0.180 | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 501.4 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | 9.7 | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.099 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.381 | 0.477 | Netherlands |
| BERD performed in service industries (%) | 1.1E-04 | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 23.7 | 125.6 | Finland |
| Triadic patent families (per million pop.) | 32.4 | 120.1 | Japan |
| Firm entries (birth rate) | [0.11] | 0.163 | Hungary |
| GDP (per capita) | 22700 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | [0.007] | 0.084 | Denmark |
| SMEs reporting non technological change (%) | [0.221] | 0.358 | Slovakia |
| GDP per capita (in PPS) | 100.0 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.024 | 0.087 | Latvia |
| Total employment growth | 0.007 | 0.038 | Cyprus |
| Long term unemployment rate | 0.041 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.091 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 2.096 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | [0.62] | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.138 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | [0.149] | 1.173 | Luxembourg |



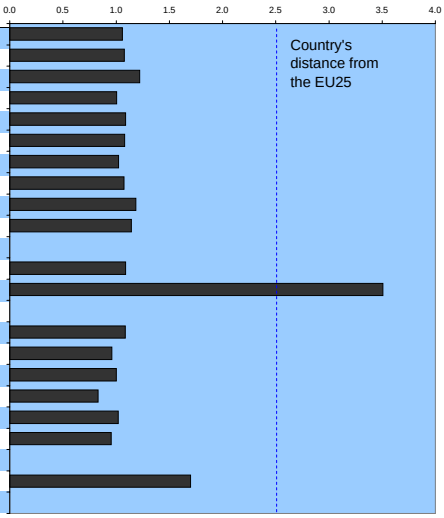
# EU15

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 57 | 39 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 46 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 68 | 21 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 46 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 | 11 | 4 | 14 | 7 | 11 | 14 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 7 | 39 | 14 | 21 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social performance** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 7 | 7 | 7 | 0 | 29 | 32 | 4 | 7 | 0 | 0 | 0 |
| **Internationalisation** | 0 | 0 | 25 | 39 | 0 | 14 | 18 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 15 | 17 | Finland |
| Internet use by firms | 12 | 14 | UK |
| Internet use by individuals | 11 | 15 | Denmark |
| Government ICT | 12 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 9 | 8 | Finland |
| Human resource in S&T education | 12 | 16 | Finland |
| Skills | 10 | 11 | Sweden |
| Creativity | 12 | 16 | Netherlands |
| Mobility | 20 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 14 | 16 | Sweden |
| Patents | 11 | 13 | Finland |
| Bibliometrics | 8 | 9 | Sweden |
| Knowledge flows | 9 | 8 | Finland |
| Total investment in intangibles | 10 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 14 | 10 | Hungary |
| Demand for innovative products | 14 | 16 | Sweden |
| Financing of innovation | 10 | 20 | Denmark |
| Market innovation outputs | 10 | 12 | Malta |
| Organisational indicators | 23 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 23 | 25 | Luxembourg |
| Productivity | 12 | 14 | Luxembourg |
| Employment | 14 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 29 | 6 | Latvia |
| Employment and economic welfare | 16 | 18 | Japan |
| Quality of life indicators | 11 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 11 | 12 | Luxembourg |
| Knowledge production and diffusion | 2 | 8 | Luxembourg |
| Economic structure | 2 | 1 | EU25 |
| Human resources | 14 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 3 | Above the EU25 average |
| 23 | Close to the EU25 average |
| 3 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer |
|---|---|---|
| ICT value-added (% of total business sector value added) | 0.046 | 0.096 Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.280 | 0.530 UK |
| Individuals using the internet for banking (% total) | 0.220 | 0.500 Finland |
| Pisa reading literacy of 15y (average score) | 503.0 | 543.0 Finland |
| Total researchers (per 1000 labour force in FTE) | 10.6 | 22.3 Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.107 | 0.321 Sweden |
| Employed in creative occupations (% total) | 0.389 | 0.477 Netherlands |
| BERD performed in service industries (%) | 1.2E-04 | 2.7E-04 Sweden |
| EPO high tech patent applications (per million pop.) | 28.1 | 125.6 Finland |
| Triadic patent families (per million pop.) | 37.0 | 120.1 Japan |
| Firm entries (birth rate) | [0.095] | 0.163 Hungary |
| GDP (per capita) | 24700 | 54700 Luxembourg |
| Early-stage venture capital ( % GDP) | 0.023 | 0.084 Denmark |
| SMEs reporting non technological change (%) | [0.274] | 0.358 Slovakia |
| GDP per capita (in PPS) | 108.6 | 240.7 Luxembourg |
| Real GDP growth rate | 0.023 | 0.087 Latvia |
| Total employment growth | 0.007 | 0.038 Cyprus |
| Long term unemployment rate | 0.034 | 0.118 USA |
| Hampered in daily activities because of chronic conditions | 0.093 | 0.164 Ireland |
| Rooms per person by tenure status and type of housing | 2.000 | 2.600 Netherlands |
| Technology balance of payments (% GERD) | [0.587] | 1.646 Luxembourg |
| Co authorship share on international S&E articles | 0.234 | 0.322 Luxembourg |
| Foreign PhD students (% total PhD enrolment) | [0.179] | 1.173 Luxembourg |



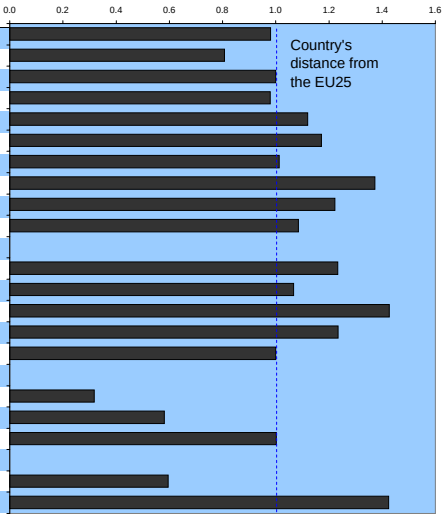
# Austria

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 50 | 18 | 7 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 7 | 18 | 29 | 39 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 11 | 18 | 25 | 18 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 25 | 21 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 4 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 39 | 32 | 0 | 0 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 21 | 14 | 36 | 0 | 4 | 7 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social performance** | 0 | 25 | 61 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 0 | 0 | 32 | 36 | 11 | 14 | 0 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 19 | 17 | Finland |
| Internet use by firms | 15 | 14 | UK |
| Internet use by individuals | 13 | 15 | Denmark |
| Government ICT | 5 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 20 | 8 | Finland |
| Human resource in S&T education | 13 | 16 | Finland |
| Skills | 9 | 11 | Sweden |
| Creativity | 15 | 16 | Netherlands |
| Mobility | 10 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 7 | 16 | Sweden |
| Patents | 9 | 13 | Finland |
| Bibliometrics | 14 | 9 | Sweden |
| Knowledge flows | 19 | 8 | Finland |
| Total investment in intangibles | 12 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 20 | 10 | Hungary |
| Demand for innovative products | 13 | 16 | Sweden |
| Financing of innovation | 19 | 20 | Denmark |
| Market innovation outputs | 17 | 12 | Malta |
| Organisational indicators | 25 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 13 | 25 | Luxembourg |
| Productivity | 7 | 14 | Luxembourg |
| Employment | 15 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 3 | 6 | Latvia |
| Employment and economic welfare | 9 | 18 | Japan |
| Quality of life indicators | 10 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 8 | 12 | Luxembourg |
| Knowledge production and diffusion | 6 | 8 | Luxembourg |
| Economic structure | 10 | 1 | EU25 |
| Human resources | 5 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 10 | Above the EU25 average |
| 12 | Close to the EU25 average |
| 7 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer |
|---|---|---|
| ICT value-added (% of total business sector value added) | 0.042 | 0.096 Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.210 | 0.530 UK |
| Individuals using the internet for banking (% total) | 0.180 | 0.500 Finland |
| Pisa reading literacy of 15y (average score) | 491.0 | 543.0 Finland |
| Total researchers (per 1000 labour force in FTE) | 10.9 | 22.3 Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.116 | 0.321 Sweden |
| Employed in creative occupations (% total) | 0.386 | 0.477 Netherlands |
| BERD performed in service industries (%) | 1.5E-04 | 2.7E-04 Sweden |
| EPO high tech patent applications (per million pop.) | 29.0 | 125.6 Finland |
| Triadic patent families (per million pop.) | 35.2 | 120.1 Japan |
| Firm entries (birth rate) | [0.087] | 0.163 Hungary |
| GDP (per capita) | 28000 | 54700 Luxembourg |
| Early-stage venture capital ( % GDP) | 0.007 | 0.084 Denmark |
| SMEs reporting non technological change (%) | 0.315 | 0.358 Slovakia |
| GDP per capita (in PPS) | 123.4 | 240.7 Luxembourg |
| Real GDP growth rate | 0.024 | 0.087 Latvia |
| Total employment growth | 0.000 | 0.038 Cyprus |
| Long term unemployment rate | 0.013 | 0.118 USA |
| Hampered in daily activities because of chronic conditions | 0.053 | 0.164 Ireland |
| Rooms per person by tenure status and type of housing | 2.100 | 2.600 Netherlands |
| Technology balance of payments (% GERD) | [0.755] | 1.646 Luxembourg |
| Co authorship share on international S&E articles | 0.082 | 0.322 Luxembourg |
| Foreign PhD students (% total PhD enrolment) | 0.213 | 1.173 Luxembourg |



# Belgium

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 4 | 11 | 57 | 16 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 7 | 46 | 7 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 46 | 54 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 4 | 4 | 0 | 0 | 4 | 18 | 43 | 7 | 0 | 4 | 11 | 0 | 0 | 0 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 36 | 25 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social performance** | 0 | 0 | 0 | 0 | 0 | 7 | 75 | 4 | 0 | 11 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 14 | 64 | 4 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 18 | 17 | Finland |
| Internet use by firms | 16 | 14 | UK |
| Internet use by individuals | 14 | 15 | Denmark |
| Government ICT | 11 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 10 | 8 | Finland |
| Human resource in S&T education | 11 | 16 | Finland |
| Skills | 14 | 11 | Sweden |
| Creativity | 6 | 16 | Netherlands |
| Mobility | 17 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 15 | 16 | Sweden |
| Patents | 12 | 13 | Finland |
| Bibliometrics | 11 | 9 | Sweden |
| Knowledge flows | 13 | 8 | Finland |
| Total investment in intangibles | 17 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 4 | 10 | Hungary |
| Demand for innovative products | 25 | 16 | Sweden |
| Financing of innovation | 13 | 20 | Denmark |
| Market innovation outputs | 19 | 12 | Malta |
| Organisational indicators | 20 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 10 | 25 | Luxembourg |
| Productivity | 3 | 14 | Luxembourg |
| Employment | 23 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 8 | 6 | Latvia |
| Employment and economic welfare | 20 | 18 | Japan |
| Quality of life indicators | 1 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 5 | 12 | Luxembourg |
| Knowledge production and diffusion | 4 | 8 | Luxembourg |
| Economic structure | 5 | 1 | EU25 |
| Human resources | 6 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 8 | Above the EU25 average |
| 14 | Close to the EU25 average |
| 7 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.044 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.090 | 0.530 | UK |
| Individuals using the internet for banking (% total) | [0.099] | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 507.0 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | 11.6 | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.086 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.430 | 0.477 | Netherlands |
| BERD performed in service industries (%) | 1.3E-04 | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 23.4 | 125.6 | Finland |
| Triadic patent families (per million pop.) | 34.4 | 120.1 | Japan |
| Firm entries (birth rate) | [0.119] | 0.163 | Hungary |
| GDP (per capita) | 27100 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | 0.016 | 0.084 | Denmark |
| SMEs reporting non technological change (%) | 0.256 | 0.358 | Slovakia |
| GDP per capita (in PPS) | 119.3 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.030 | 0.087 | Latvia |
| Total employment growth | 0.006 | 0.038 | Cyprus |
| Long term unemployment rate | 0.041 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.056 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 2.100 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | 0.797 | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.108 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | 0.313 | 1.173 | Luxembourg |

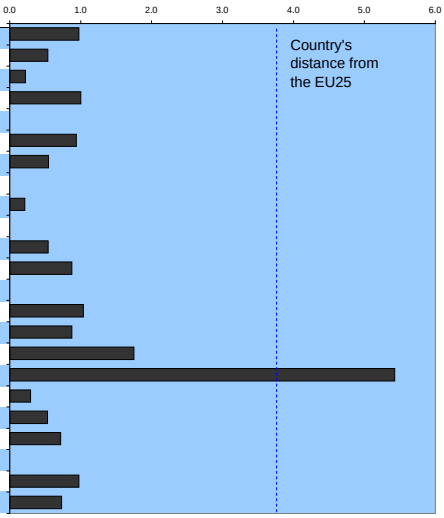
# Cyprus

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 7 | 4 | 23 | 23 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 7 | 14 | 36 | 14 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 14 | 57 | 7 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 11 | 7 | 0 | 14 | 7 | 0 | 14 | 14 | 29 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 7 | 25 | 7 | 0 | 0 | 7 | 0 | 7 | 0 | 39 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social performance** | 0 | 0 | 0 | 4 | 4 | 7 | 0 | 14 | 18 | 18 | 11 | 11 | 0 | 4 | 4 | 0 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 0 | 0 | 0 | 0 | 14 | 14 | 32 | 25 | 4 | 4 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 28 | 17 | Finland |
| Internet use by firms | 20 | 14 | UK |
| Internet use by individuals | 26 | 15 | Denmark |
| Government ICT | 27 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 5 | 8 | Finland |
| Human resource in S&T education | 17 | 16 | Finland |
| Skills | 13 | 11 | Sweden |
| Creativity | 29 | 16 | Netherlands |
| Mobility | 8 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 9 | 16 | Sweden |
| Patents | 15 | 13 | Finland |
| Bibliometrics | 29 | 9 | Sweden |
| Knowledge flows | 27 | 8 | Finland |
| Total investment in intangibles | 11 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 29 | 10 | Hungary |
| Demand for innovative products | 11 | 16 | Sweden |
| Financing of innovation | 7 | 20 | Denmark |
| Market innovation outputs | 29 | 12 | Malta |
| Organisational indicators | 16 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 12 | 25 | Luxembourg |
| Productivity | 27 | 14 | Luxembourg |
| Employment | 1 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 27 | 6 | Latvia |
| Employment and economic welfare | 5 | 18 | Japan |
| Quality of life indicators | 5 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 15 | 12 | Luxembourg |
| Knowledge production and diffusion | 5 | 8 | Luxembourg |
| Economic structure | 14 | 1 | EU25 |
| Human resources | 4 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 8 | Above the EU25 average |
| 9 | Close to the EU25 average |
| 12 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.042 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.140 | 0.530 | UK |
| Individuals using the internet for banking (% total) | 0.040 | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 503.2 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | [10.434] | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.093 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.209 | 0.477 | Netherlands |
| BERD performed in service industries (%) | [0] | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 5.1 | 125.6 | Finland |
| Triadic patent families (per million pop.) | [69.74] | 120.1 | Japan |
| Firm entries (birth rate) | 0.059 | 0.163 | Hungary |
| GDP (per capita) | 19900 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | [0.032] | 0.084 | Denmark |
| SMEs reporting non technological change (%) | 0.229 | 0.358 | Slovakia |
| GDP per capita (in PPS) | 87.6 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.042 | 0.087 | Latvia |
| Total employment growth | 0.038 | 0.038 | Cyprus |
| Long term unemployment rate | 0.012 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.049 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 1.502 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | [1.053] | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.134 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | 0.109 | 1.173 | Luxembourg |



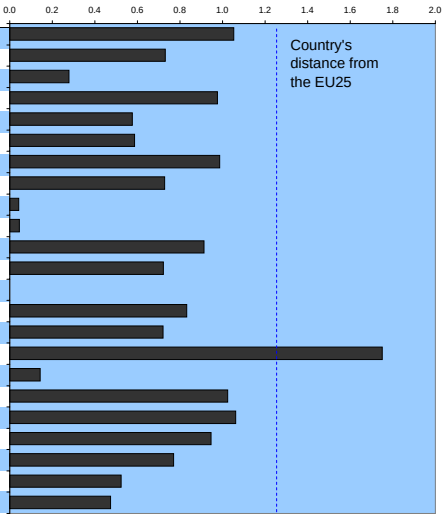
# Czech. Rep.

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 7 | 30 | 39 | 5 | 7 | 7 | 0 | 0 | 0 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 50 | 0 | 7 | 14 | 0 | 14 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 0 | 4 | 0 | 4 | 0 | 64 | 21 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 14 | 29 | 18 | 29 | 0 | 0 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 4 | 0 | 0 | 0 | 0 | 4 | 7 | 29 | 11 | 18 | 14 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 57 | 7 | 29 | 7 | 0 | 0 | 0 | 0 |
| **Social performance** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 11 | 4 | 82 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 11 | 4 | 0 | 0 | 25 | 7 | 25 | 14 | 0 | 0 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 21 | 17 | Finland |
| Internet use by firms | 19 | 14 | UK |
| Internet use by individuals | 27 | 15 | Denmark |
| Government ICT | 23 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 23 | 8 | Finland |
| Human resource in S&T education | 27 | 16 | Finland |
| Skills | 22 | 11 | Sweden |
| Creativity | 18 | 16 | Netherlands |
| Mobility | 22 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 22 | 16 | Sweden |
| Patents | 25 | 13 | Finland |
| Bibliometrics | 23 | 9 | Sweden |
| Knowledge flows | 18 | 8 | Finland |
| Total investment in intangibles | 13 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 18 | 10 | Hungary |
| Demand for innovative products | 10 | 16 | Sweden |
| Financing of innovation | 23 | 20 | Denmark |
| Market innovation outputs | 13 | 12 | Malta |
| Organisational indicators | 10 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 22 | 25 | Luxembourg |
| Productivity | 21 | 14 | Luxembourg |
| Employment | 20 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 22 | 6 | Latvia |
| Employment and economic welfare | 17 | 18 | Japan |
| Quality of life indicators | 23 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 14 | 12 | Luxembourg |
| Knowledge production and diffusion | 20 | 8 | Luxembourg |
| Economic structure | 3 | 1 | EU25 |
| Human resources | 20 | 17 | Luxembourg |

| Number of KEI sub-indices (total of 29) | |
|---|---|
| 1 | Above the EU25 average |
| 9 | Close to the EU25 average |
| 19 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.045 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.190 | 0.530 | UK |
| Individuals using the internet for banking (% total) | 0.050 | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 489.0 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | 5.6 | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.058 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.376 | 0.477 | Netherlands |
| BERD performed in service industries (%) | 8.0E-05 | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 1.0 | 125.6 | Finland |
| Triadic patent families (per million pop.) | 1.4 | 120.1 | Japan |
| Firm entries (birth rate) | 0.100 | 0.163 | Hungary |
| GDP (per capita) | 16400 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | 0.000 | 0.084 | Denmark |
| SMEs reporting non technological change (%) | 0.183 | 0.358 | Slovakia |
| GDP per capita (in PPS) | 72.1 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.042 | 0.087 | Latvia |
| Total employment growth | 0.001 | 0.038 | Cyprus |
| Long term unemployment rate | 0.042 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.097 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 1.981 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | 0.477 | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.072 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | 0.071 | 1.173 | Luxembourg |



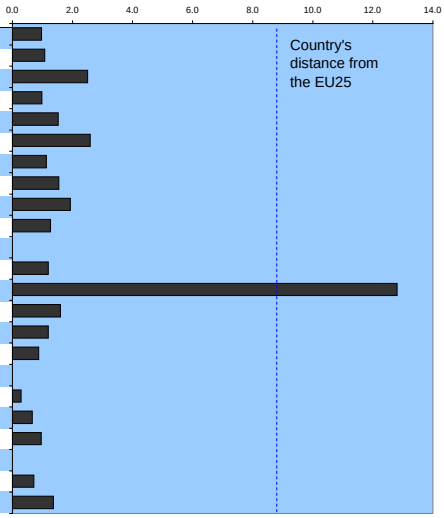
# Denmark

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 55 | 30 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 89 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 0 | 29 | 29 | 18 | 21 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 14 | 64 | 18 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 0 | 0 | 4 | 50 | 11 | 18 | 11 | 0 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 7 | 14 | 7 | 7 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social performance** | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 29 | 54 | 7 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 11 | 17 | Finland |
| Internet use by firms | 2 | 14 | UK |
| Internet use by individuals | 1 | 15 | Denmark |
| Government ICT | 3 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 16 | 8 | Finland |
| Human resource in S&T education | 3 | 16 | Finland |
| Skills | 3 | 11 | Sweden |
| Creativity | 7 | 16 | Netherlands |
| Mobility | 3 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 5 | 16 | Sweden |
| Patents | 6 | 13 | Finland |
| Bibliometrics | 3 | 9 | Sweden |
| Knowledge flows | 15 | 8 | Finland |
| Total investment in intangibles | 14 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 16 | 10 | Hungary |
| Demand for innovative products | 5 | 16 | Sweden |
| Financing of innovation | 1 | 20 | Denmark |
| Market innovation outputs | 15 | 12 | Malta |
| Organisational indicators | 28 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 18 | 25 | Luxembourg |
| Productivity | 13 | 14 | Luxembourg |
| Employment | 6 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 4 | 6 | Latvia |
| Employment and economic welfare | 2 | 18 | Japan |
| Quality of life indicators | 3 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 7 | 12 | Luxembourg |
| Knowledge production and diffusion | 18 | 8 | Luxembourg |
| Economic structure | 13 | 1 | EU25 |
| Human resources | 7 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 17 | Above the EU25 average |
| 5 | Close to the EU25 average |
| 7 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.042 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.280 | 0.530 | UK |
| Individuals using the internet for banking (% total) | 0.450 | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 492.0 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | 14.8 | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.256 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.429 | 0.477 | Netherlands |
| BERD performed in service industries (%) | 1.7E-04 | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 45.8 | 125.6 | Finland |
| Triadic patent families (per million pop.) | 41.1 | 120.1 | Japan |
| Firm entries (birth rate) | [0.094] | 0.163 | Hungary |
| GDP (per capita) | 27100 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | 0.084 | 0.084 | Denmark |
| SMEs reporting non technological change (%) | 0.353 | 0.358 | Slovakia |
| GDP per capita (in PPS) | 119.4 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.021 | 0.087 | Latvia |
| Total employment growth | 0.000 | 0.038 | Cyprus |
| Long term unemployment rate | 0.012 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.060 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 2.000 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | [0.419] | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.099 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | 0.204 | 1.173 | Luxembourg |



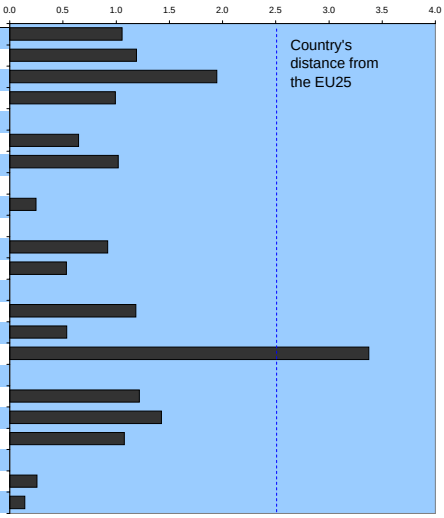
# Estonia

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 36 | 25 | 21 | 11 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 11 | 46 | 39 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 14 | 14 | 57 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 75 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 0 | 0 | 0 | 7 | 46 | 32 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 79 | 4 | 4 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social performance** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 7 | 43 |
| **Internationalisation** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 11 | 46 | 32 | 7 | 0 | |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 9 | 17 | Finland |
| Internet use by firms | 18 | 14 | UK |
| Internet use by individuals | 10 | 15 | Denmark |
| Government ICT | 6 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 19 | 8 | Finland |
| Human resource in S&T education | 8 | 16 | Finland |
| Skills | 18 | 11 | Sweden |
| Creativity | 14 | 16 | Netherlands |
| Mobility | 13 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 12 | 16 | Sweden |
| Patents | 20 | 13 | Finland |
| Bibliometrics | 22 | 9 | Sweden |
| Knowledge flows | 23 | 8 | Finland |
| Total investment in intangibles | 15 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 15 | 10 | Hungary |
| Demand for innovative products | 2 | 16 | Sweden |
| Financing of innovation | 15 | 20 | Denmark |
| Market innovation outputs | 8 | 12 | Malta |
| Organisational indicators | 22 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 5 | 25 | Luxembourg |
| Productivity | 17 | 14 | Luxembourg |
| Employment | 22 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 25 | 6 | Latvia |
| Employment and economic welfare | 24 | 18 | Japan |
| Quality of life indicators | 29 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 24 | 12 | Luxembourg |
| Knowledge production and diffusion | 27 | 8 | Luxembourg |
| Economic structure | 18 | 1 | EU25 |
| Human resources | 22 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 8 | Above the EU25 average |
| 5 | Close to the EU25 average |
| 16 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.046 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.310 | 0.530 | UK |
| Individuals using the internet for banking (% total) | 0.350 | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 497.2 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | [14.884] | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.064 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.388 | 0.477 | Netherlands |
| BERD performed in service industries (%) | [0] | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 5.8 | 125.6 | Finland |
| Triadic patent families (per million pop.) | [13.877] | 120.1 | Japan |
| Firm entries (birth rate) | 0.101 | 0.163 | Hungary |
| GDP (per capita) | 12100 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | [0.013] | 0.084 | Denmark |
| SMEs reporting non technological change (%) | 0.261 | 0.358 | Slovakia |
| GDP per capita (in PPS) | 53.4 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.081 | 0.087 | Latvia |
| Total employment growth | 0.000 | 0.038 | Cyprus |
| Long term unemployment rate | 0.050 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.130 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 2.256 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | [0.49] | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.035 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | 0.021 | 1.173 | Luxembourg |



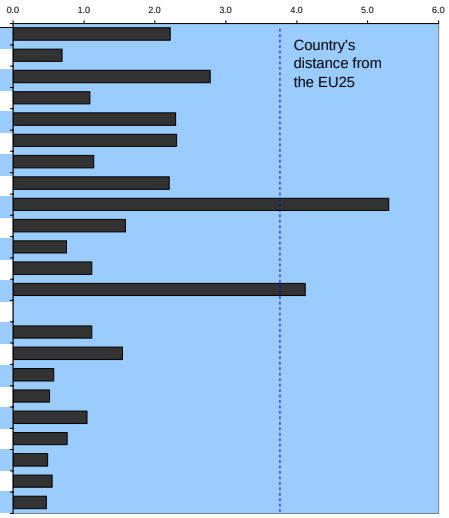
# Finland

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 18 | 23 | 29 | 9 | 11 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Production and diffusion of ICT** | 54 | 46 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 | 21 | 0 | 14 | 11 | 7 | 7 | 4 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 14 | 7 | 14 | 4 | 43 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social performance** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 11 | 11 | 54 | 4 | 4 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 7 | 7 | 14 | 14 | 11 | 11 | 4 | 0 | 0 | 18 | 7 | 4 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 1 | 17 | Finland |
| Internet use by firms | 9 | 14 | UK |
| Internet use by individuals | 3 | 15 | Denmark |
| Government ICT | 1 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 1 | 8 | Finland |
| Human resource in S&T education | 1 | 16 | Finland |
| Skills | 4 | 11 | Sweden |
| Creativity | 5 | 16 | Netherlands |
| Mobility | 4 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 2 | 16 | Sweden |
| Patents | 1 | 13 | Finland |
| Bibliometrics | 4 | 9 | Sweden |
| Knowledge flows | 1 | 8 | Finland |
| Total investment in intangibles | 9 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 19 | 10 | Hungary |
| Demand for innovative products | 12 | 16 | Sweden |
| Financing of innovation | 8 | 20 | Denmark |
| Market innovation outputs | 11 | 12 | Malta |
| Organisational indicators | 18 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 8 | 25 | Luxembourg |
| Productivity | 16 | 14 | Luxembourg |
| Employment | 11 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 7 | 6 | Latvia |
| Employment and economic welfare | 15 | 18 | Japan |
| Quality of life indicators | 19 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 4 | 12 | Luxembourg |
| Knowledge production and diffusion | 28 | 8 | Luxembourg |
| Economic structure | 28 | 1 | EU25 |
| Human resources | 13 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 17 | Above the EU25 average |
| 8 | Close to the EU25 average |
| 4 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.096 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.180 | 0.530 | UK |
| Individuals using the internet for banking (% total) | 0.500 | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 543.0 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | 22.3 | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.228 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.432 | 0.477 | Netherlands |
| BERD performed in service industries (%) | 2.4E-04 | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 125.6 | 125.6 | Finland |
| Triadic patent families (per million pop.) | 51.3 | 120.1 | Japan |
| Firm entries (birth rate) | 0.083 | 0.163 | Hungary |
| GDP (per capita) | 25200 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | 0.027 | 0.084 | Denmark |
| SMEs reporting non technological change (%) | [0.243] | 0.358 | Slovakia |
| GDP per capita (in PPS) | 111.1 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.037 | 0.087 | Latvia |
| Total employment growth | 0.004 | 0.038 | Cyprus |
| Long term unemployment rate | 0.021 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.095 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 1.600 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | 0.301 | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.076 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | 0.070 | 1.173 | Luxembourg |



# France

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 14 | 18 | 11 | 54 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 68 | 18 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 86 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 4 | 0 | 18 | 29 | 4 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 0 | 0 | 14 | 18 | 18 | 18 | 29 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 50 | 14 | 0 | 7 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social performance** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 0 | 18 | 36 | 11 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 25 | 29 | 25 | 11 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 13 | 17 | Finland |
| Internet use by firms | 10 | 14 | UK |
| Internet use by individuals | 12 | 15 | Denmark |
| Government ICT | 10 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 13 | 8 | Finland |
| Human resource in S&T education | 5 | 16 | Finland |
| Skills | 17 | 11 | Sweden |
| Creativity | 17 | 16 | Netherlands |
| Mobility | 5 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 8 | 16 | Sweden |
| Patents | 10 | 13 | Finland |
| Bibliometrics | 13 | 9 | Sweden |
| Knowledge flows | 21 | 8 | Finland |
| Total investment in intangibles | 7 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 8 | 10 | Hungary |
| Demand for innovative products | 19 | 16 | Sweden |
| Financing of innovation | 9 | 20 | Denmark |
| Market innovation outputs | 20 | 12 | Malta |
| Organisational indicators | 7 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 20 | 25 | Luxembourg |
| Productivity | 6 | 14 | Luxembourg |
| Employment | 21 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 11 | 6 | Latvia |
| Employment and economic welfare | 21 | 18 | Japan |
| Quality of life indicators | 17 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 14 | 12 | Luxembourg |
| Knowledge production and diffusion | 13 | 8 | Luxembourg |
| Economic structure | 7 | 1 | EU25 |
| Human resources | 11 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 10 | Above the EU25 average |
| 14 | Close to the EU25 average |
| 5 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.047 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | [0.328] | 0.530 | UK |
| Individuals using the internet for banking (% total) | [0.192] | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 496.0 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | 12.9 | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.070 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.380 | 0.477 | Netherlands |
| BERD performed in service industries (%) | 1.3E-04 | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 32.1 | 125.6 | Finland |
| Triadic patent families (per million pop.) | 39.1 | 120.1 | Japan |
| Firm entries (birth rate) | [0.115] | 0.163 | Hungary |
| GDP (per capita) | 24400 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | 0.025 | 0.084 | Denmark |
| SMEs reporting non technological change (%) | 0.158 | 0.358 | Slovakia |
| GDP per capita (in PPS) | 107.6 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.025 | 0.087 | Latvia |
| Total employment growth | 0.000 | 0.038 | Cyprus |
| Long term unemployment rate | 0.039 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.104 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 2.000 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | [0.094] | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.164 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | [0.19] | 1.173 | Luxembourg |

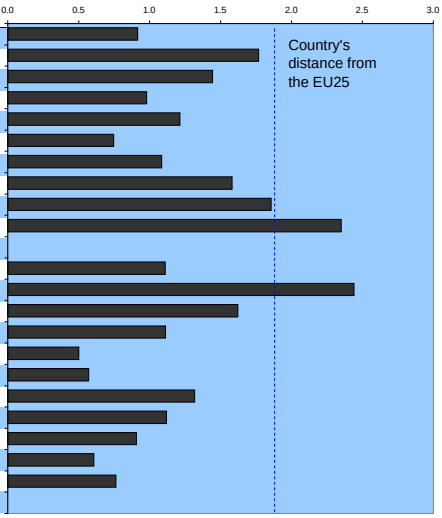
# Germany

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 79 | 4 | 7 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 21 | 39 | 7 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 46 | 21 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 7 | 4 | 0 | 11 | 29 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 39 | 32 | 11 | 4 | 11 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 82 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social performance** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 50 | 46 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 18 | 4 | 7 | 36 | 14 | 7 | 4 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 16 | 17 | Finland |
| Internet use by firms | 3 | 14 | UK |
| Internet use by individuals | 8 | 15 | Denmark |
| Government ICT | 17 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 11 | 8 | Finland |
| Human resource in S&T education | 14 | 16 | Finland |
| Skills | 16 | 11 | Sweden |
| Creativity | 8 | 16 | Netherlands |
| Mobility | 19 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 6 | 16 | Sweden |
| Patents | 4 | 13 | Finland |
| Bibliometrics | 10 | 9 | Sweden |
| Knowledge flows | 28 | 8 | Finland |
| Total investment in intangibles | 12 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 3 | 10 | Hungary |
| Demand for innovative products | 23 | 16 | Sweden |
| Financing of innovation | 13 | 20 | Denmark |
| Market innovation outputs | 25 | 12 | Malta |
| Organisational indicators | 29 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 26 | 25 | Luxembourg |
| Productivity | 15 | 14 | Luxembourg |
| Employment | 18 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 24 | 6 | Latvia |
| Employment and economic welfare | 19 | 18 | Japan |
| Quality of life indicators | 13 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 9 | 12 | Luxembourg |
| Knowledge production and diffusion | 16 | 8 | Luxembourg |
| Economic structure | 26 | 1 | EU25 |
| Human resources | 10 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 8 | Above the EU25 average |
| 13 | Close to the EU25 average |
| 8 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.040 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.460 | 0.530 | UK |
| Individuals using the internet for banking (% total) | 0.260 | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 491.0 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | 11.8 | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.074 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.413 | 0.477 | Netherlands |
| BERD performed in service industries (%) | 1.7E-04 | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 44.0 | 125.6 | Finland |
| Triadic patent families (per million pop.) | 76.2 | 120.1 | Japan |
| Firm entries (birth rate) | [0.13] | 0.163 | Hungary |
| GDP (per capita) | 25200 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | 0.016 | 0.084 | Denmark |
| SMEs reporting non technological change (%) | 0.358 | 0.358 | Slovakia |
| GDP per capita (in PPS) | 111.1 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.012 | 0.087 | Latvia |
| Total employment growth | 0.004 | 0.038 | Cyprus |
| Long term unemployment rate | 0.054 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.102 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 1.900 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | 0.377 | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.105 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | [0.183] | 1.173 | Luxembourg |



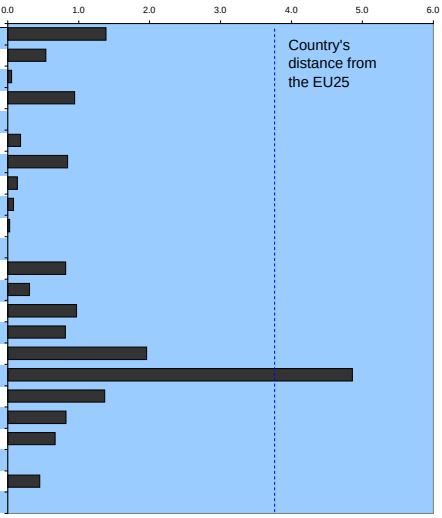
# Greece

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 4 | 29 | 18 | 21 | 7 | 14 | 0 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 57 | 21 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 89 | 11 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 46 | 46 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 7 | 0 | 4 | 0 | 32 | 43 | 11 | 0 | 0 | 0 | 0 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 89 | 7 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social performance** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 4 | 4 | 14 | 18 | 25 | 0 | 0 | 29 | 0 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 14 | 82 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 3 | 17 | Finland |
| Internet use by firms | 21 | 14 | UK |
| Internet use by individuals | 28 | 15 | Denmark |
| Government ICT | 20 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 27 | 8 | Finland |
| Human resource in S&T education | 23 | 16 | Finland |
| Skills | 27 | 11 | Sweden |
| Creativity | 25 | 16 | Netherlands |
| Mobility | 20 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 28 | 16 | Sweden |
| Patents | 26 | 13 | Finland |
| Bibliometrics | 21 | 9 | Sweden |
| Knowledge flows | 26 | 8 | Finland |
| Total investment in intangibles | 17 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 22 | 10 | Hungary |
| Demand for innovative products | 24 | 16 | Sweden |
| Financing of innovation | 22 | 20 | Denmark |
| Market innovation outputs | 6 | 12 | Malta |
| Organisational indicators | 14 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 11 | 25 | Luxembourg |
| Productivity | 10 | 14 | Luxembourg |
| Employment | 7 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 17 | 6 | Latvia |
| Employment and economic welfare | 26 | 18 | Japan |
| Quality of life indicators | 14 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 26 | 12 | Luxembourg |
| Knowledge production and diffusion | 25 | 8 | Luxembourg |
| Economic structure | 27 | 1 | EU25 |
| Human resources | 19 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 3 | Above the EU25 average |
| 8 | Close to the EU25 average |
| 18 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.060 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.140 | 0.530 | UK |
| Individuals using the internet for banking (% total) | 0.010 | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 472.0 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | [5.822] | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.018 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.321 | 0.477 | Netherlands |
| BERD performed in service industries (%) | 1.5E-05 | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 1.9 | 125.6 | Finland |
| Triadic patent families (per million pop.) | 0.9 | 120.1 | Japan |
| Firm entries (birth rate) | [0.084] | 0.163 | Hungary |
| GDP (per capita) | 18500 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | 0.002 | 0.084 | Denmark |
| SMEs reporting non technological change (%) | 0.214 | 0.358 | Slovakia |
| GDP per capita (in PPS) | 81.4 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.047 | 0.087 | Latvia |
| Total employment growth | 0.034 | 0.038 | Cyprus |
| Long term unemployment rate | 0.056 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.075 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 1.400 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | [0.271] | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.062 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | [0.118] | 1.173 | Luxembourg |



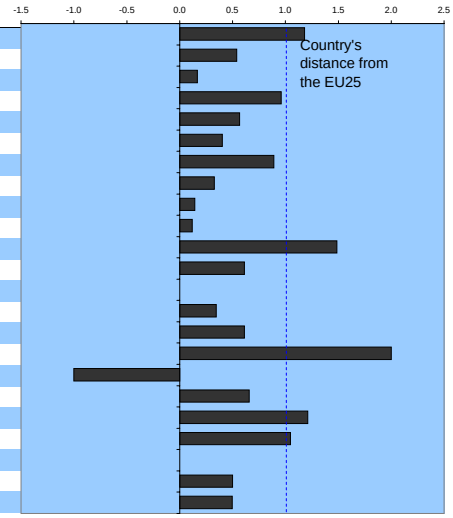
# Hungary

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 13 | 13 | 57 | 2 | 14 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 18 | 0 | 7 | 18 | 32 | 14 | 7 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 64 | 36 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 21 | 36 | 11 | 11 | 14 | 0 | 0 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 4 | 0 | 0 | 4 | 11 | 25 | 0 | 4 | 0 | 4 | 0 | 0 | 11 | 4 | 4 | 11 | 4 | 11 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 93 | 4 | 0 |
| **Social performance** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 7 | 4 | 36 | 4 | 39 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 18 | 25 | 25 | 4 | 0 | 0 | 0 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 12 | 17 | Finland |
| Internet use by firms | 22 | 14 | UK |
| Internet use by individuals | 26 | 15 | Denmark |
| Government ICT | 28 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 25 | 8 | Finland |
| Human resource in S&T education | 28 | 16 | Finland |
| Skills | 26 | 11 | Sweden |
| Creativity | 21 | 16 | Netherlands |
| Mobility | 23 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 26 | 16 | Sweden |
| Patents | 24 | 13 | Finland |
| Bibliometrics | 20 | 9 | Sweden |
| Knowledge flows | 20 | 8 | Finland |
| Total investment in intangibles | 6 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 1 | 10 | Hungary |
| Demand for innovative products | 22 | 16 | Sweden |
| Financing of innovation | 23 | 20 | Denmark |
| Market innovation outputs | 28 | 12 | Malta |
| Organisational indicators | 2 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 21 | 25 | Luxembourg |
| Productivity | 25 | 14 | Luxembourg |
| Employment | 28 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 9 | 6 | Latvia |
| Employment and economic welfare | 12 | 18 | Japan |
| Quality of life indicators | 22 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 19 | 12 | Luxembourg |
| Knowledge production and diffusion | 24 | 8 | Luxembourg |
| Economic structure | 17 | 1 | EU25 |
| Human resources | 24 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 4 | Above the EU25 average |
| 5 | Close to the EU25 average |
| 20 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.051 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.140 | 0.530 | UK |
| Individuals using the internet for banking (% total) | 0.030 | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 482.0 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | 5.5 | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.040 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.339 | 0.477 | Netherlands |
| BERD performed in service industries (%) | 3.6E-05 | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 3.4 | 125.6 | Finland |
| Triadic patent families (per million pop.) | 3.9 | 120.1 | Japan |
| Firm entries (birth rate) | 0.163 | 0.163 | Hungary |
| GDP (per capita) | 13900 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | 0.000 | 0.084 | Denmark |
| SMEs reporting non technological change (%) | 0.076 | 0.358 | Slovakia |
| GDP per capita (in PPS) | 61.3 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.048 | 0.087 | Latvia |
| Total employment growth | -0.007 | 0.038 | Cyprus |
| Long term unemployment rate | 0.027 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.111 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 2.193 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | [0.434] | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.069 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | 0.074 | 1.173 | Luxembourg |



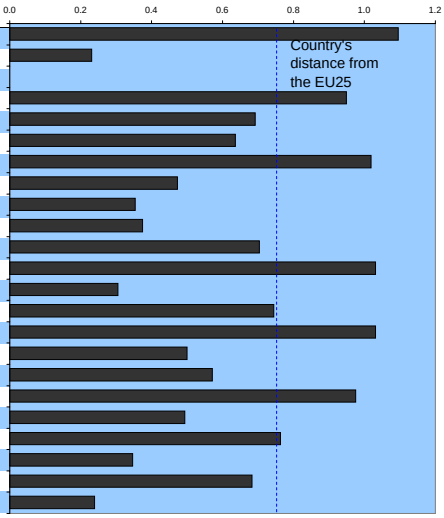
# Italy

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 18 | 9 | 29 | 9 | 7 | 0 | 0 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 93 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 64 | 25 | 4 | 0 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 11 | 14 | 4 | 7 | 0 | 14 | 29 | 4 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 32 | 57 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 71 | 25 | 0 | 0 | 0 | 0 | 0 |
| **Social performance** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 0 | 4 | 43 | 0 | 21 | 7 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 14 | 43 | 25 | 0 | 0 | 0 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 20 | 17 | Finland |
| Internet use by firms | 23 | 14 | UK |
| Internet use by individuals | 18 | 15 | Denmark |
| Government ICT | 8 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 21 | 8 | Finland |
| Human resource in S&T education | 24 | 16 | Finland |
| Skills | 19 | 11 | Sweden |
| Creativity | 13 | 16 | Netherlands |
| Mobility | 21 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 24 | 16 | Sweden |
| Patents | 18 | 13 | Finland |
| Bibliometrics | 17 | 9 | Sweden |
| Knowledge flows | 29 | 8 | Finland |
| Total investment in intangibles | 17 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 26 | 10 | Hungary |
| Demand for innovative products | 29 | 16 | Sweden |
| Financing of innovation | 22 | 20 | Denmark |
| Market innovation outputs | 21 | 12 | Malta |
| Organisational indicators | 8 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 27 | 25 | Luxembourg |
| Productivity | 11 | 14 | Luxembourg |
| Employment | 25 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 13 | 6 | Latvia |
| Employment and economic welfare | 21 | 18 | Japan |
| Quality of life indicators | 15 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 13 | 12 | Luxembourg |
| Knowledge production and diffusion | 23 | 8 | Luxembourg |
| Economic structure | 23 | 1 | EU25 |
| Human resources | 26 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 2 | Above the EU25 average |
| 8 | Close to the EU25 average |
| 19 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer |
|---|---|---|
| ICT value-added (% of total business sector value added) | 0.047 | 0.096 Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.060 | 0.530 UK |
| Individuals using the internet for banking (% total) | [0.081] | 0.500 Finland |
| Pisa reading literacy of 15y (average score) | 476.0 | 543.0 Finland |
| Total researchers (per 1000 labour force in FTE) | 6.7 | 22.3 Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.063 | 0.321 Sweden |
| Employed in creative occupations (% total) | 0.388 | 0.477 Netherlands |
| BERD performed in service industries (%) | 5.2E-05 | 2.7E-04 Sweden |
| EPO high tech patent applications (per million pop.) | 8.4 | 125.6 Finland |
| Triadic patent families (per million pop.) | 12.1 | 120.1 Japan |
| Firm entries (birth rate) | 0.077 | 0.163 Hungary |
| GDP (per capita) | 23400 | 54700 Luxembourg |
| Early-stage venture capital ( % GDP) | 0.002 | 0.084 Denmark |
| SMEs reporting non technological change (%) | 0.164 | 0.358 Slovakia |
| GDP per capita (in PPS) | 103.1 | 240.7 Luxembourg |
| Real GDP growth rate | 0.012 | 0.087 Latvia |
| Total employment growth | 0.004 | 0.038 Cyprus |
| Long term unemployment rate | 0.040 | 0.118 USA |
| Hampered in daily activities because of chronic conditions | 0.045 | 0.164 Ireland |
| Rooms per person by tenure status and type of housing | 1.600 | 2.600 Netherlands |
| Technology balance of payments (% GERD) | 0.215 | 1.646 Luxembourg |
| Co authorship share on international S&E articles | 0.094 | 0.322 Luxembourg |
| Foreign PhD students (% total PhD enrolment) | 0.036 | 1.173 Luxembourg |



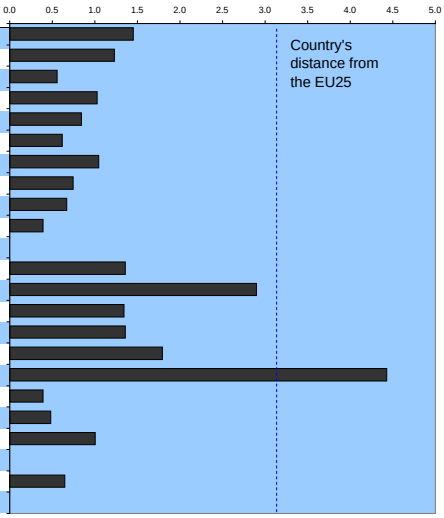
# Ireland

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 61 | 14 | 4 | 9 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 36 | 11 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 82 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 86 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 11 | 0 | 7 | 0 | 18 | 11 | 14 | 7 | 7 | 7 | 4 | 4 | 0 | 4 | 4 | 0 | 0 | 0 | 0 |
| **Economic outputs** | 29 | 71 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social performance** | 0 | 0 | 0 | 4 | 7 | 0 | 4 | 7 | 25 | 18 | 4 | 4 | 11 | 4 | 0 | 4 | 0 | 0 | 7 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 0 | 0 | 4 | 0 | 14 | 11 | 4 | 4 | 21 | 0 | 14 | 14 | 11 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 10 | 17 | Finland |
| Internet use by firms | 7 | 14 | UK |
| Internet use by individuals | 22 | 15 | Denmark |
| Government ICT | 14 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 3 | 8 | Finland |
| Human resource in S&T education | 7 | 16 | Finland |
| Skills | 20 | 11 | Sweden |
| Creativity | 11 | 16 | Netherlands |
| Mobility | 9 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 21 | 16 | Sweden |
| Patents | 17 | 13 | Finland |
| Bibliometrics | 16 | 9 | Sweden |
| Knowledge flows | 22 | 8 | Finland |
| Total investment in intangibles | 3 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 24 | 10 | Hungary |
| Demand for innovative products | 3 | 16 | Sweden |
| Financing of innovation | 11 | 20 | Denmark |
| Market innovation outputs | 18 | 12 | Malta |
| Organisational indicators | 24 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 3 | 25 | Luxembourg |
| Productivity | 2 | 14 | Luxembourg |
| Employment | 2 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 28 | 6 | Latvia |
| Employment and economic welfare | 7 | 18 | Japan |
| Quality of life indicators | 2 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 2 | 12 | Luxembourg |
| Knowledge production and diffusion | 11 | 8 | Luxembourg |
| Economic structure | 25 | 1 | EU25 |
| Human resources | 8 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 16 | Above the EU25 average |
| 3 | Close to the EU25 average |
| 10 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.063 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.320 | 0.530 | UK |
| Individuals using the internet for banking (% total) | 0.100 | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 515.0 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | 8.2 | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.061 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.398 | 0.477 | Netherlands |
| BERD performed in service industries (%) | 8.2E-05 | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 15.9 | 125.6 | Finland |
| Triadic patent families (per million pop.) | 12.7 | 120.1 | Japan |
| Firm entries (birth rate) | [0.077] | 0.163 | Hungary |
| GDP (per capita) | 30800 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | 0.019 | 0.084 | Denmark |
| SMEs reporting non technological change (%) | 0.296 | 0.358 | Slovakia |
| GDP per capita (in PPS) | 135.6 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.043 | 0.087 | Latvia |
| Total employment growth | 0.031 | 0.038 | Cyprus |
| Long term unemployment rate | 0.016 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.044 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 2.100 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | [0.557] | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.089 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | [0.236] | 1.173 | Luxembourg |



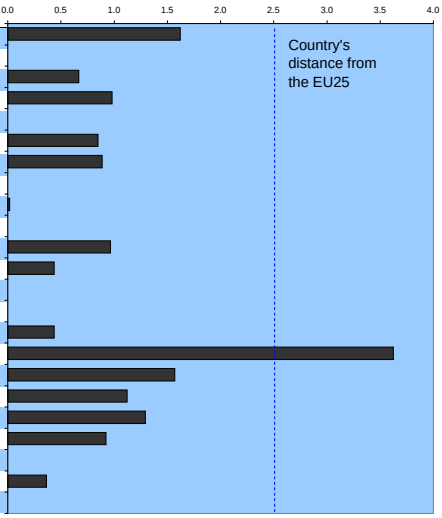
# Latvia

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 36 | 11 | 21 | 7 | 0 | 5 | 0 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 0 | 25 | 4 | 14 | 21 | 14 | 0 | 7 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 43 | 36 | 0 | 4 | 11 | 0 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 7 | 11 | 18 | 11 | 4 | 36 | 7 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 0 | 0 | 0 | 7 | 7 | 0 | 7 | 29 | 21 | 14 | 7 | 0 | 0 | 0 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 39 | 29 | 7 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social performance** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 7 | 14 | 4 | 4 | 29 | 32 | 7 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 68 | 14 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 5 | 17 | Finland |
| Internet use by firms | 26 | 14 | UK |
| Internet use by individuals | 23 | 15 | Denmark |
| Government ICT | 29 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 24 | 8 | Finland |
| Human resource in S&T education | 19 | 16 | Finland |
| Skills | 15 | 11 | Sweden |
| Creativity | 22 | 16 | Netherlands |
| Mobility | 14 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 20 | 16 | Sweden |
| Patents | 23 | 13 | Finland |
| Bibliometrics | 28 | 9 | Sweden |
| Knowledge flows | 3 | 8 | Finland |
| Total investment in intangibles | 20 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 6 | 10 | Hungary |
| Demand for innovative products | 20 | 16 | Sweden |
| Financing of innovation | 14 | 20 | Denmark |
| Market innovation outputs | 27 | 12 | Malta |
| Organisational indicators | 12 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 4 | 25 | Luxembourg |
| Productivity | 26 | 14 | Luxembourg |
| Employment | 17 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 1 | 6 | Latvia |
| Employment and economic welfare | 23 | 18 | Japan |
| Quality of life indicators | 28 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 28 | 12 | Luxembourg |
| Knowledge production and diffusion | 17 | 8 | Luxembourg |
| Economic structure | 24 | 1 | EU25 |
| Human resources | 25 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 6 | Above the EU25 average |
| 8 | Close to the EU25 average |
| 15 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.070 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | [0.068] | 0.530 | UK |
| Individuals using the internet for banking (% total) | 0.120 | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 491.0 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | [7.297] | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.084 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.338 | 0.477 | Netherlands |
| BERD performed in service industries (%) | [0] | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 0.4 | 125.6 | Finland |
| Triadic patent families (per million pop.) | [11.002] | 120.1 | Japan |
| Firm entries (birth rate) | 0.106 | 0.163 | Hungary |
| GDP (per capita) | 9900 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | [0.014] | 0.084 | Denmark |
| SMEs reporting non technological change (%) | [0.201] | 0.358 | Slovakia |
| GDP per capita (in PPS) | 43.7 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.087 | 0.087 | Latvia |
| Total employment growth | 0.011 | 0.038 | Cyprus |
| Long term unemployment rate | 0.046 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.118 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 1.936 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | [0.516] | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.050 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | [0.01] | 1.173 | Luxembourg |



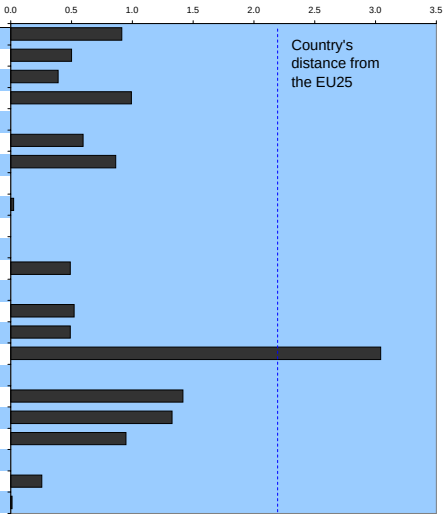
# Lithuania

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 41 | 13 | 32 | 11 | 0 | 0 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 43 | 36 | 7 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 46 | 43 | 4 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 25 | 14 | 4 | 11 | 29 | 7 | 7 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 4 | 14 | 29 | 18 | 14 | 7 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 14 | 54 | 4 | 0 | 0 | 0 | 0 |
| **Social performance** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 86 | 7 | 0 | 0 |
| **Internationalisation** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 50 | 29 | 0 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 23 | 17 | Finland |
| Internet use by firms | 24 | 14 | UK |
| Internet use by individuals | 24 | 15 | Denmark |
| Government ICT | 21 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 12 | 8 | Finland |
| Human resource in S&T education | 15 | 16 | Finland |
| Skills | 21 | 11 | Sweden |
| Creativity | 24 | 16 | Netherlands |
| Mobility | 15 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 13 | 16 | Sweden |
| Patents | 21 | 13 | Finland |
| Bibliometrics | 27 | 9 | Sweden |
| Knowledge flows | 10 | 8 | Finland |
| Total investment in intangibles | 20 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 12 | 10 | Hungary |
| Demand for innovative products | 18 | 16 | Sweden |
| Financing of innovation | 12 | 20 | Denmark |
| Market innovation outputs | 24 | 12 | Malta |
| Organisational indicators | 4 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 7 | 25 | Luxembourg |
| Productivity | 28 | 14 | Luxembourg |
| Employment | 24 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 21 | 6 | Latvia |
| Employment and economic welfare | 25 | 18 | Japan |
| Quality of life indicators | 26 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 25 | 12 | Luxembourg |
| Knowledge production and diffusion | 19 | 8 | Luxembourg |
| Economic structure | 21 | 1 | EU25 |
| Human resources | 27 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 4 | Above the EU25 average |
| 5 | Close to the EU25 average |
| 20 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.039 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.130 | 0.530 | UK |
| Individuals using the internet for banking (% total) | 0.070 | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 497.4 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | [9.882] | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.059 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.329 | 0.477 | Netherlands |
| BERD performed in service industries (%) | [0] | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 0.6 | 125.6 | Finland |
| Triadic patent families (per million pop.) | [17.173] | 120.1 | Japan |
| Firm entries (birth rate) | [0.101] | 0.163 | Hungary |
| GDP (per capita) | 11100 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | [0.018] | 0.084 | Denmark |
| SMEs reporting non technological change (%) | 0.115 | 0.358 | Slovakia |
| GDP per capita (in PPS) | 49.0 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.073 | 0.087 | Latvia |
| Total employment growth | 0.000 | 0.038 | Cyprus |
| Long term unemployment rate | 0.058 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.121 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 1.985 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | [0.607] | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.035 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | 0.002 | 1.173 | Luxembourg |



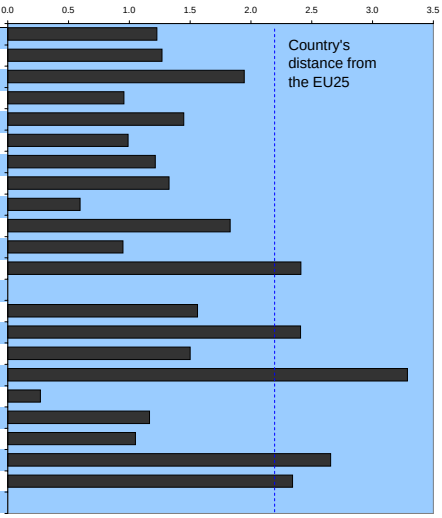
# Luxembourg

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 36 | 4 | 14 | 25 | 4 | 7 | 7 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 0 | 0 | 14 | 61 | 11 | 4 | 4 | 0 | 0 | 4 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 50 | 21 | 0 | 4 | 4 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 0 | 0 | 32 | 46 | 14 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 11 | 32 | 39 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Economic outputs** | 71 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social performance** | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 46 | 18 | 18 | 7 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 86 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 14 | 17 | Finland |
| Internet use by firms | 13 | 14 | UK |
| Internet use by individuals | 4 | 15 | Denmark |
| Government ICT | 9 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 18 | 8 | Finland |
| Human resource in S&T education | 4 | 16 | Finland |
| Skills | 12 | 11 | Sweden |
| Creativity | 2 | 16 | Netherlands |
| Mobility | 21 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 11 | 16 | Sweden |
| Patents | 8 | 13 | Finland |
| Bibliometrics | 15 | 9 | Sweden |
| Knowledge flows | 16 | 8 | Finland |
| Total investment in intangibles | 2 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 11 | 10 | Hungary |
| Demand for innovative products | 4 | 16 | Sweden |
| Financing of innovation | 5 | 20 | Denmark |
| Market innovation outputs | 5 | 12 | Malta |
| Organisational indicators | 27 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 1 | 25 | Luxembourg |
| Productivity | 1 | 14 | Luxembourg |
| Employment | 8 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 19 | 6 | Latvia |
| Employment and economic welfare | 11 | 18 | Japan |
| Quality of life indicators | 7 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 1 | 12 | Luxembourg |
| Knowledge production and diffusion | 1 | 8 | Luxembourg |
| Economic structure | 22 | 1 | EU25 |
| Human resources | 1 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 17 | Above the EU25 average |
| 5 | Close to the EU25 average |
| 7 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.053 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.330 | 0.530 | UK |
| Individuals using the internet for banking (% total) | 0.350 | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 479.0 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | 14.1 | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.098 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.462 | 0.477 | Netherlands |
| BERD performed in service industries (%) | 1.5E-04 | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 14.1 | 125.6 | Finland |
| Triadic patent families (per million pop.) | 59.3 | 120.1 | Japan |
| Firm entries (birth rate) | 0.104 | 0.163 | Hungary |
| GDP (per capita) | 54700 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | [0.048] | 0.084 | Denmark |
| SMEs reporting non technological change (%) | 0.345 | 0.358 | Slovakia |
| GDP per capita (in PPS) | 240.7 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.036 | 0.087 | Latvia |
| Total employment growth | 0.023 | 0.038 | Cyprus |
| Long term unemployment rate | 0.011 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.106 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 2.200 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | 1.646 | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.322 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | [1.173] | 1.173 | Luxembourg |



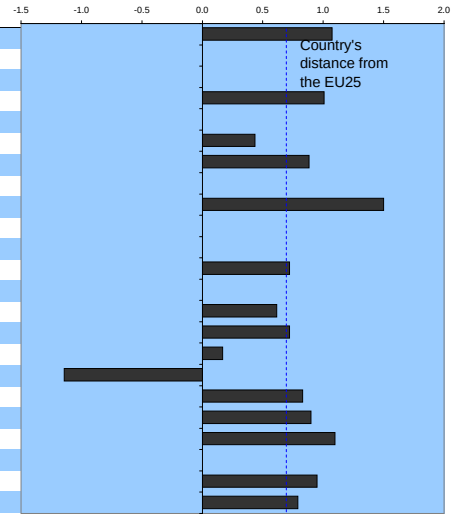
# Malta

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 13 | 9 | 21 | 23 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 32 | 39 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 36 | 21 | 14 | 21 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 0 | 7 | 7 | 0 | 11 | 7 | 4 | 7 | 7 | 36 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 32 | 7 | 7 | 0 | 11 | 11 | 4 | 14 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| **Social performance** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 4 | 14 | 32 | 32 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 14 | 39 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 22 | 17 | Finland |
| Internet use by firms | 5 | 14 | UK |
| Internet use by individuals | 17 | 15 | Denmark |
| Government ICT | 13 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 15 | 8 | Finland |
| Human resource in S&T education | 22 | 16 | Finland |
| Skills | 25 | 11 | Sweden |
| Creativity | 23 | 16 | Netherlands |
| Mobility | 18 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 17 | 16 | Sweden |
| Patents | 16 | 13 | Finland |
| Bibliometrics | 12 | 9 | Sweden |
| Knowledge flows | 24 | 8 | Finland |
| Total investment in intangibles | 1 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 17 | 10 | Hungary |
| Demand for innovative products | 27 | 16 | Sweden |
| Financing of innovation | 16 | 20 | Denmark |
| Market innovation outputs | 1 | 12 | Malta |
| Organisational indicators | 6 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 29 | 25 | Luxembourg |
| Productivity | 22 | 14 | Luxembourg |
| Employment | 29 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 23 | 6 | Latvia |
| Employment and economic welfare | 14 | 18 | Japan |
| Quality of life indicators | 18 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 22 | 12 | Luxembourg |
| Knowledge production and diffusion | 9 | 8 | Luxembourg |
| Economic structure | 11 | 1 | EU25 |
| Human resources | 18 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 5 | Above the EU25 average |
| 9 | Close to the EU25 average |
| 15 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.046 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | [0.444] | 0.530 | UK |
| Individuals using the internet for banking (% total) | [0.113] | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 504.7 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | [6.969] | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.043 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.336 | 0.477 | Netherlands |
| BERD performed in service industries (%) | [0] | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 35.6 | 125.6 | Finland |
| Triadic patent families (per million pop.) | [23.45] | 120.1 | Japan |
| Firm entries (birth rate) | [0.096] | 0.163 | Hungary |
| GDP (per capita) | 16400 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | [0.009] | 0.084 | Denmark |
| SMEs reporting non technological change (%) | 0.136 | 0.358 | Slovakia |
| GDP per capita (in PPS) | 72.0 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.004 | 0.087 | Latvia |
| Total employment growth | -0.008 | 0.038 | Cyprus |
| Long term unemployment rate | 0.034 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.082 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 2.299 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | [0.579] | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.131 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | 0.118 | 1.173 | Luxembourg |



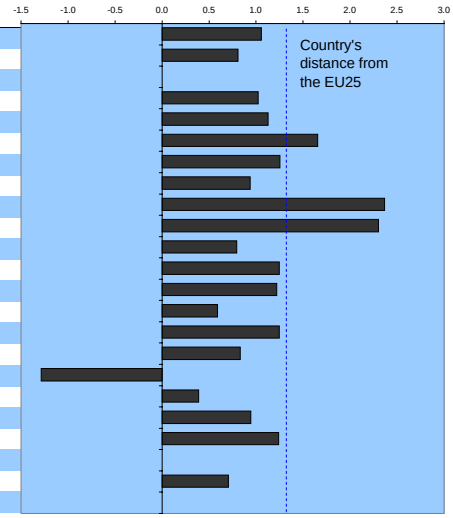
# Netherlands

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 86 | 4 | 0 | 4 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 57 | 18 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 0 | 0 | 11 | 71 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 82 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 7 | 0 | 4 | 4 | 36 | 25 | 11 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 50 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social performance** | 0 | 0 | 14 | 71 | 4 | 0 | 7 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 21 | 36 | 21 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 6 | 17 | Finland |
| Internet use by firms | 11 | 14 | UK |
| Internet use by individuals | 5 | 15 | Denmark |
| Government ICT | 18 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 7 | 8 | Finland |
| Human resource in S&T education | 21 | 16 | Finland |
| Skills | 5 | 11 | Sweden |
| Creativity | 1 | 16 | Netherlands |
| Mobility | 11 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 10 | 16 | Sweden |
| Patents | 5 | 13 | Finland |
| Bibliometrics | 5 | 9 | Sweden |
| Knowledge flows | 14 | 8 | Finland |
| Total investment in intangibles | 8 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 21 | 10 | Hungary |
| Demand for innovative products | 21 | 16 | Sweden |
| Financing of innovation | 18 | 20 | Denmark |
| Market innovation outputs | 16 | 12 | Malta |
| Organisational indicators | 5 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 15 | 25 | Luxembourg |
| Productivity | 9 | 14 | Luxembourg |
| Employment | 12 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 12 | 6 | Latvia |
| Employment and economic welfare | 3 | 18 | Japan |
| Quality of life indicators | 6 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 6 | 12 | Luxembourg |
| Knowledge production and diffusion | 7 | 8 | Luxembourg |
| Economic structure | 19 | 1 | EU25 |
| Human resources | 12 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 12 | Above the EU25 average |
| 13 | Close to the EU25 average |
| 4 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.046 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.210 | 0.530 | UK |
| Individuals using the internet for banking (% total) | [0.184] | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 513.0 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | 11.0 | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.164 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.477 | 0.477 | Netherlands |
| BERD performed in service industries (%) | 1.0E-04 | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 56.1 | 125.6 | Finland |
| Triadic patent families (per million pop.) | 74.6 | 120.1 | Japan |
| Firm entries (birth rate) | 0.087 | 0.163 | Hungary |
| GDP (per capita) | 28300 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | 0.008 | 0.084 | Denmark |
| SMEs reporting non technological change (%) | 0.130 | 0.358 | Slovakia |
| GDP per capita (in PPS) | 124.6 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.020 | 0.087 | Latvia |
| Total employment growth | -0.009 | 0.038 | Cyprus |
| Long term unemployment rate | 0.016 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.086 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 2.600 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | [0.371] | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.097 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | [0.228] | 1.173 | Luxembourg |



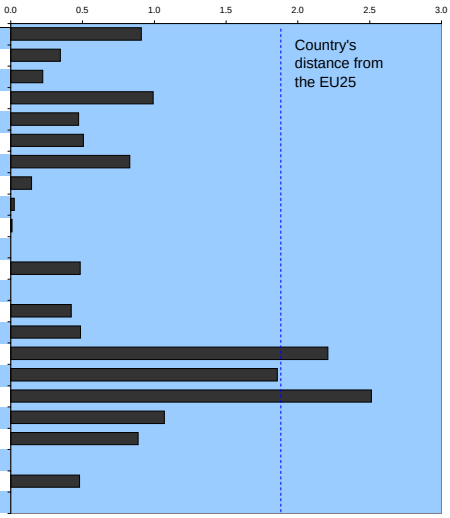
# Poland

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 14 | 79 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 43 | 54 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 4 | 0 | 0 | 4 | 0 | 11 | 4 | 0 | 7 | 14 | 0 | 11 | 11 | 7 | 14 | 7 | 0 | 0 | 0 | 0 | 0 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 93 | 0 |
| **Social performance** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 39 | 61 | 0 |
| **Internationalisation** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 46 | 39 | 7 | 7 | 0 | 0 | 0 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 26 | 17 | Finland |
| Internet use by firms | 25 | 14 | UK |
| Internet use by individuals | 25 | 15 | Denmark |
| Government ICT | 25 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 22 | 8 | Finland |
| Human resource in S&T education | 25 | 16 | Finland |
| Skills | 23 | 11 | Sweden |
| Creativity | 26 | 16 | Netherlands |
| Mobility | 22 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 27 | 16 | Sweden |
| Patents | 29 | 13 | Finland |
| Bibliometrics | 26 | 9 | Sweden |
| Knowledge flows | 17 | 8 | Finland |
| Total investment in intangibles | 20 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 7 | 10 | Hungary |
| Demand for innovative products | 26 | 16 | Sweden |
| Financing of innovation | 23 | 20 | Denmark |
| Market innovation outputs | 23 | 12 | Malta |
| Organisational indicators | 3 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 24 | 25 | Luxembourg |
| Productivity | 29 | 14 | Luxembourg |
| Employment | 26 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 20 | 6 | Latvia |
| Employment and economic welfare | 27 | 18 | Japan |
| Quality of life indicators | 25 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 16 | 12 | Luxembourg |
| Knowledge production and diffusion | 22 | 8 | Luxembourg |
| Economic structure | 16 | 1 | EU25 |
| Human resources | 28 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 1 | Above the EU25 average |
| 3 | Close to the EU25 average |
| 25 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.039 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.090 | 0.530 | UK |
| Individuals using the internet for banking (% total) | 0.040 | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 497.0 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | 4.6 | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.050 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.315 | 0.477 | Netherlands |
| BERD performed in service industries (%) | 1.6E-05 | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 0.6 | 125.6 | Finland |
| Triadic patent families (per million pop.) | 0.3 | 120.1 | Japan |
| Firm entries (birth rate) | [0.099] | 0.163 | Hungary |
| GDP (per capita) | 11000 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | 0.000 | 0.084 | Denmark |
| SMEs reporting non technological change (%) | 0.093 | 0.358 | Slovakia |
| GDP per capita (in PPS) | 48.6 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.053 | 0.087 | Latvia |
| Total employment growth | 0.013 | 0.038 | Cyprus |
| Long term unemployment rate | 0.103 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.098 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 1.857 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | [0.86] | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.066 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | [0.008] | 1.173 | Luxembourg |



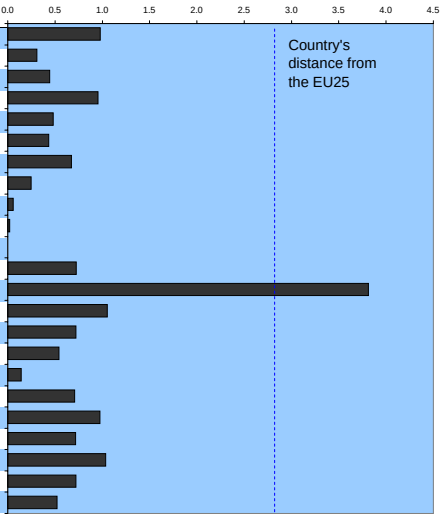
# Portugal

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 4 | 0 | 7 | 11 | 61 | 14 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 50 | 14 | 7 | 14 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 29 | 64 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 32 | 18 | 4 | 36 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 0 | 7 | 32 | 50 | 4 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 7 | 0 | 0 | 43 | 43 | 0 | 4 | 0 |
| **Social performance** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 4 | 21 | 11 | 29 | 18 | 7 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 11 | 4 | 4 | 4 | 36 | 11 | 18 | 4 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 24 | 17 | Finland |
| Internet use by firms | 27 | 14 | UK |
| Internet use by individuals | 20 | 15 | Denmark |
| Government ICT | 22 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 28 | 8 | Finland |
| Human resource in S&T education | 26 | 16 | Finland |
| Skills | 25 | 11 | Sweden |
| Creativity | 28 | 16 | Netherlands |
| Mobility | 16 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 25 | 16 | Sweden |
| Patents | 27 | 13 | Finland |
| Bibliometrics | 24 | 9 | Sweden |
| Knowledge flows | 6 | 8 | Finland |
| Total investment in intangibles | 16 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 25 | 10 | Hungary |
| Demand for innovative products | 28 | 16 | Sweden |
| Financing of innovation | 9 | 20 | Denmark |
| Market innovation outputs | 26 | 12 | Malta |
| Organisational indicators | 17 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 28 | 25 | Luxembourg |
| Productivity | 24 | 14 | Luxembourg |
| Employment | 13 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 14 | 6 | Latvia |
| Employment and economic welfare | 13 | 18 | Japan |
| Quality of life indicators | 21 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 27 | 12 | Luxembourg |
| Knowledge production and diffusion | 15 | 8 | Luxembourg |
| Economic structure | 4 | 1 | EU25 |
| Human resources | 21 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 2 | Above the EU25 average |
| 5 | Close to the EU25 average |
| 22 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.042 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.080 | 0.530 | UK |
| Individuals using the internet for banking (% total) | 0.080 | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 478.0 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | 4.7 | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.043 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.257 | 0.477 | Netherlands |
| BERD performed in service industries (%) | 2.7E-05 | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 1.4 | 125.6 | Finland |
| Triadic patent families (per million pop.) | 0.7 | 120.1 | Japan |
| Firm entries (birth rate) | [0.067] | 0.163 | Hungary |
| GDP (per capita) | 16400 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | 0.025 | 0.084 | Denmark |
| SMEs reporting non technological change (%) | 0.232 | 0.358 | Slovakia |
| GDP per capita (in PPS) | 72.1 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.013 | 0.087 | Latvia |
| Total employment growth | 0.001 | 0.038 | Cyprus |
| Long term unemployment rate | 0.029 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.089 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 1.500 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | 0.643 | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.099 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | 0.078 | 1.173 | Luxembourg |



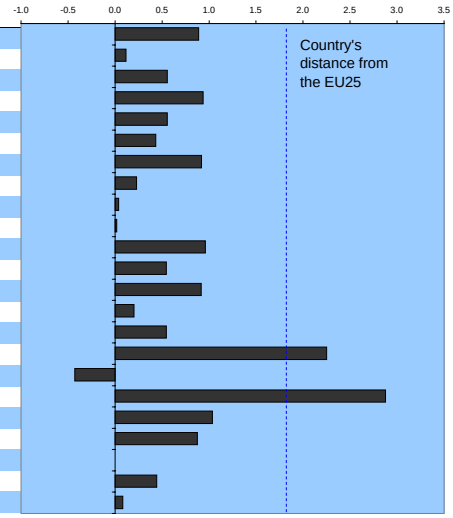
# Slovakia

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 7 | 18 | 71 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 14 | 57 | 21 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 14 | 79 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 14 | 43 | 7 | 0 |
| **Innovation, entrepreneurship, creative production** | 7 | 14 | 61 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 46 | 54 | 0 | 0 | 0 |
| **Social performance** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 32 | 57 |
| **Internationalisation** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 4 | 4 | 21 | 0 | 0 | 18 | 39 | 4 | 0 | 4 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 25 | 17 | Finland |
| Internet use by firms | 29 | 14 | UK |
| Internet use by individuals | 21 | 15 | Denmark |
| Government ICT | 26 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 26 | 8 | Finland |
| Human resource in S&T education | 18 | 16 | Finland |
| Skills | 25 | 11 | Sweden |
| Creativity | 20 | 16 | Netherlands |
| Mobility | 24 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 28 | 16 | Sweden |
| Patents | 28 | 13 | Finland |
| Bibliometrics | 25 | 9 | Sweden |
| Knowledge flows | 2 | 8 | Finland |
| Total investment in intangibles | 19 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 5 | 10 | Hungary |
| Demand for innovative products | 6 | 16 | Sweden |
| Financing of innovation | 21 | 20 | Denmark |
| Market innovation outputs | 7 | 12 | Malta |
| Organisational indicators | 1 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 17 | 25 | Luxembourg |
| Productivity | 23 | 14 | Luxembourg |
| Employment | 27 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 18 | 6 | Latvia |
| Employment and economic welfare | 28 | 18 | Japan |
| Quality of life indicators | 27 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 21 | 12 | Luxembourg |
| Knowledge production and diffusion | 26 | 8 | Luxembourg |
| Economic structure | 9 | 1 | EU25 |
| Human resources | 29 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 3 | Above the EU25 average |
| 6 | Close to the EU25 average |
| 20 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.038 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.030 | 0.530 | UK |
| Individuals using the internet for banking (% total) | 0.100 | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 469.0 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | 5.4 | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.043 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.350 | 0.477 | Netherlands |
| BERD performed in service industries (%) | 2.5E-05 | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 0.9 | 125.6 | Finland |
| Triadic patent families (per million pop.) | 0.5 | 120.1 | Japan |
| Firm entries (birth rate) | 0.105 | 0.163 | Hungary |
| GDP (per capita) | 12400 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | 0.006 | 0.084 | Denmark |
| SMEs reporting non technological change (%) | 0.045 | 0.358 | Slovakia |
| GDP per capita (in PPS) | 54.4 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.054 | 0.087 | Latvia |
| Total employment growth | -0.003 | 0.038 | Cyprus |
| Long term unemployment rate | 0.118 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.094 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 1.837 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | [0.41] | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.061 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | 0.012 | 1.173 | Luxembourg |



# Slovenia

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 41 | 38 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 32 | 36 | 21 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 14 | 14 | 14 | 14 | 29 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 71 | 21 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 21 | 11 | 0 | 7 | 11 | 21 | 14 | 7 | 4 | 0 | 0 | 0 | 0 | 0 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 7 | 14 | 71 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social performance** | 0 | 0 | 0 | 4 | 0 | 0 | 4 | 7 | 0 | 25 | 39 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 4 | 0 | 0 | 11 | 21 | 29 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 27 | 17 | Finland |
| Internet use by firms | 17 | 14 | UK |
| Internet use by individuals | 19 | 15 | Denmark |
| Government ICT | 24 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 17 | 8 | Finland |
| Human resource in S&T education | 20 | 16 | Finland |
| Skills | 6 | 11 | Sweden |
| Creativity | 19 | 16 | Netherlands |
| Mobility | 12 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 19 | 16 | Sweden |
| Patents | 19 | 13 | Finland |
| Bibliometrics | 19 | 9 | Sweden |
| Knowledge flows | 4 | 8 | Finland |
| Total investment in intangibles | 19 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 28 | 10 | Hungary |
| Demand for innovative products | 17 | 16 | Sweden |
| Financing of innovation | 17 | 20 | Denmark |
| Market innovation outputs | 3 | 12 | Malta |
| Organisational indicators | 11 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 14 | 25 | Luxembourg |
| Productivity | 19 | 14 | Luxembourg |
| Employment | 16 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 5 | 6 | Latvia |
| Employment and economic welfare | 10 | 18 | Japan |
| Quality of life indicators | 24 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 17 | 12 | Luxembourg |
| Knowledge production and diffusion | 21 | 8 | Luxembourg |
| Economic structure | 12 | 1 | EU25 |
| Human resources | 23 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 7 | Above the EU25 average |
| 8 | Close to the EU25 average |
| 14 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.041 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.160 | 0.530 | UK |
| Individuals using the internet for banking (% total) | 0.090 | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 497.9 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | 7.1 | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.162 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.355 | 0.477 | Netherlands |
| BERD performed in service industries (%) | 9.7E-05 | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 4.3 | 125.6 | Finland |
| Triadic patent families (per million pop.) | 5.6 | 120.1 | Japan |
| Firm entries (birth rate) | [0.069] | 0.163 | Hungary |
| GDP (per capita) | 18200 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | [0.008] | 0.084 | Denmark |
| SMEs reporting non technological change (%) | [0.196] | 0.358 | Slovakia |
| GDP per capita (in PPS) | 79.9 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.044 | 0.087 | Latvia |
| Total employment growth | 0.005 | 0.038 | Cyprus |
| Long term unemployment rate | 0.032 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.077 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 1.774 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | [0.503] | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.066 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | [0.022] | 1.173 | Luxembourg |

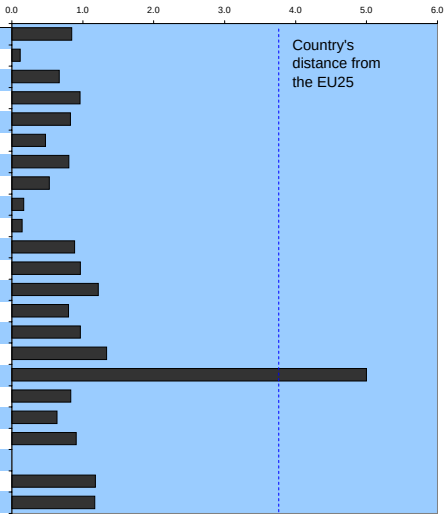
# Spain

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 32 | 25 | 29 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 7 | 7 | 43 | 21 | 7 | 7 | 0 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 7 | 0 | 0 | 21 | 18 | 43 | 7 | 0 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 14 | 14 | 0 | 18 | 21 | 18 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 18 | 32 | 18 | 21 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Economic outputs** | 0 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social performance** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 21 | 18 | 21 | 18 | 11 | 0 | 4 | 0 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 25 | 18 | 25 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 29 | 17 | Finland |
| Internet use by firms | 28 | 14 | UK |
| Internet use by individuals | 16 | 15 | Denmark |
| Government ICT | 16 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 29 | 8 | Finland |
| Human resource in S&T education | 12 | 16 | Finland |
| Skills | 24 | 11 | Sweden |
| Creativity | 27 | 16 | Netherlands |
| Mobility | 6 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 23 | 16 | Sweden |
| Patents | 22 | 13 | Finland |
| Bibliometrics | 18 | 9 | Sweden |
| Knowledge flows | 25 | 8 | Finland |
| Total investment in intangibles | 18 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 9 | 10 | Hungary |
| Demand for innovative products | 15 | 16 | Sweden |
| Financing of innovation | 18 | 20 | Denmark |
| Market innovation outputs | 22 | 12 | Malta |
| Organisational indicators | 9 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 19 | 25 | Luxembourg |
| Productivity | 4 | 14 | Luxembourg |
| Employment | 3 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 26 | 6 | Latvia |
| Employment and economic welfare | 22 | 18 | Japan |
| Quality of life indicators | 4 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 23 | 12 | Luxembourg |
| Knowledge production and diffusion | 14 | 8 | Luxembourg |
| Economic structure | 8 | 1 | EU25 |
| Human resources | 15 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 5 | Above the EU25 average |
| 10 | Close to the EU25 average |
| 14 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.036 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.030 | 0.530 | UK |
| Individuals using the internet for banking (% total) | 0.120 | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 481.0 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | 8.0 | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.047 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.306 | 0.477 | Netherlands |
| BERD performed in service industries (%) | 5.8E-05 | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 4.0 | 125.6 | Finland |
| Triadic patent families (per million pop.) | 4.7 | 120.1 | Japan |
| Firm entries (birth rate) | 0.097 | 0.163 | Hungary |
| GDP (per capita) | 21900 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | 0.008 | 0.084 | Denmark |
| SMEs reporting non technological change (%) | 0.177 | 0.358 | Slovakia |
| GDP per capita (in PPS) | 96.6 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.032 | 0.087 | Latvia |
| Total employment growth | 0.035 | 0.038 | Cyprus |
| Long term unemployment rate | 0.034 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.058 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 1.900 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | [0.361] | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.162 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | 0.175 | 1.173 | Luxembourg |



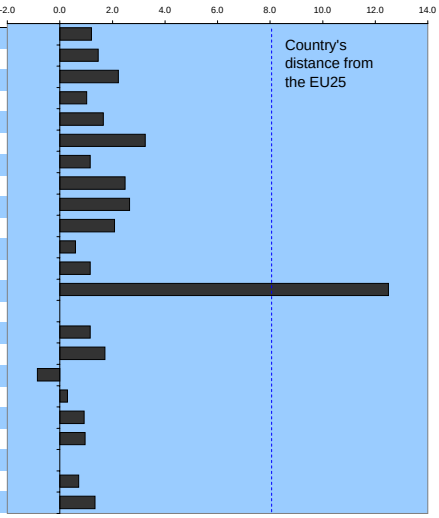
# Sweden

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 54 | 46 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Production and diffusion of ICT** | 46 | 54 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 0 | 50 | 0 | 21 | 14 | 7 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 64 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 14 | 21 | 7 | 21 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 7 | 0 | 0 | 36 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social performance** | 0 | 71 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 50 | 0 | 0 | 7 | 21 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 2 | 17 | Finland |
| Internet use by firms | 4 | 14 | UK |
| Internet use by individuals | 2 | 15 | Denmark |
| Government ICT | 2 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 2 | 8 | Finland |
| Human resource in S&T education | 2 | 16 | Finland |
| Skills | 1 | 11 | Sweden |
| Creativity | 4 | 16 | Netherlands |
| Mobility | 25 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 1 | 16 | Sweden |
| Patents | 3 | 13 | Finland |
| Bibliometrics | 1 | 9 | Sweden |
| Knowledge flows | 5 | 8 | Finland |
| Total investment in intangibles | 13 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 27 | 10 | Hungary |
| Demand for innovative products | 1 | 16 | Sweden |
| Financing of innovation | 2 | 20 | Denmark |
| Market innovation outputs | 9 | 12 | Malta |
| Organisational indicators | 19 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 6 | 25 | Luxembourg |
| Productivity | 20 | 14 | Luxembourg |
| Employment | 10 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 2 | 6 | Latvia |
| Employment and economic welfare | 6 | 18 | Japan |
| Quality of life indicators | 9 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 3 | 12 | Luxembourg |
| Knowledge production and diffusion | 12 | 8 | Luxembourg |
| Economic structure | 20 | 1 | EU25 |
| Human resources | 16 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 19 | Above the EU25 average |
| 5 | Close to the EU25 average |
| 5 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.052 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.380 | 0.530 | UK |
| Individuals using the internet for banking (% total) | 0.400 | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 514.0 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | 16.1 | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.321 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.440 | 0.477 | Netherlands |
| BERD performed in service industries (%) | 2.7E-04 | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 62.8 | 125.6 | Finland |
| Triadic patent families (per million pop.) | 67.4 | 120.1 | Japan |
| Firm entries (birth rate) | 0.065 | 0.163 | Hungary |
| GDP (per capita) | 26200 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | 0.082 | 0.084 | Denmark |
| SMEs reporting non technological change (%) | [0.252] | 0.358 | Slovakia |
| GDP per capita (in PPS) | 115.4 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.041 | 0.087 | Latvia |
| Total employment growth | -0.006 | 0.038 | Cyprus |
| Long term unemployment rate | 0.012 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.084 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 2.000 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | [0.529] | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.098 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | 0.199 | 1.173 | Luxembourg |



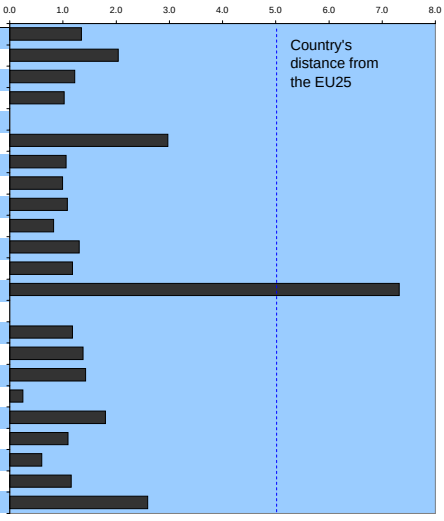
# UK

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 2 | 5 | 16 | 38 | 39 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 39 | 43 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 0 | 21 | 54 | 18 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 18 | 32 | 14 | 0 | 7 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 79 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 4 | 64 | 29 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social performance** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 4 | 57 | 14 | 11 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 0 | 0 | 18 | 11 | 11 | 7 | 39 | 11 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 4 | 17 | Finland |
| Internet use by firms | 1 | 14 | UK |
| Internet use by individuals | 9 | 15 | Denmark |
| Government ICT | 19 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 4 | 8 | Finland |
| Human resource in S&T education | 10 | 16 | Finland |
| Skills | 2 | 11 | Sweden |
| Creativity | 9 | 16 | Netherlands |
| Mobility | 2 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 18 | 16 | Sweden |
| Patents | 14 | 13 | Finland |
| Bibliometrics | 6 | 9 | Sweden |
| Knowledge flows | 12 | 8 | Finland |
| Total investment in intangibles | 5 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 2 | 10 | Hungary |
| Demand for innovative products | 7 | 16 | Sweden |
| Financing of innovation | 4 | 20 | Denmark |
| Market innovation outputs | 2 | 12 | Malta |
| Organisational indicators | 21 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 9 | 25 | Luxembourg |
| Productivity | 18 | 14 | Luxembourg |
| Employment | 5 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 15 | 6 | Latvia |
| Employment and economic welfare | 8 | 18 | Japan |
| Quality of life indicators | 20 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 20 | 12 | Luxembourg |
| Knowledge production and diffusion | 3 | 8 | Luxembourg |
| Economic structure | 15 | 1 | EU25 |
| Human resources | 2 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 17 | Above the EU25 average |
| 6 | Close to the EU25 average |
| 6 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.058 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | 0.530 | 0.530 | UK |
| Individuals using the internet for banking (% total) | 0.220 | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 512.2 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | [9.38] | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | 0.294 | 0.321 | Sweden |
| Employed in creative occupations (% total) | 0.403 | 0.477 | Netherlands |
| BERD performed in service industries (%) | 1.1E-04 | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 25.7 | 125.6 | Finland |
| Triadic patent families (per million pop.) | 26.8 | 120.1 | Japan |
| Firm entries (birth rate) | 0.143 | 0.163 | Hungary |
| GDP (per capita) | 26800 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | 0.048 | 0.084 | Denmark |
| SMEs reporting non technological change (%) | [0.26] | 0.358 | Slovakia |
| GDP per capita (in PPS) | 118.0 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.033 | 0.087 | Latvia |
| Total employment growth | 0.010 | 0.038 | Cyprus |
| Long term unemployment rate | 0.010 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.164 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 2.300 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | 0.374 | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.159 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | 0.386 | 1.173 | Luxembourg |



# Japan

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 0 | 0 | 4 | 7 | 18 | 32 | 36 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 0 | 7 | 21 | 57 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 0 | 18 | 36 | 43 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 36 | 64 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 43 | 18 | 29 | 7 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Economic outputs** | 0 | 0 | 0 | 0 | 0 | 0 | 61 | 4 | 25 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social performance** | 0 | 0 | 0 | 0 | 0 | 71 | 14 | 4 | 4 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 7 | 0 | 18 | 46 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 7 | 17 | Finland |
| Internet use by firms | 8 | 14 | UK |
| Internet use by individuals | 7 | 15 | Denmark |
| Government ICT | 7 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 14 | 8 | Finland |
| Human resource in S&T education | 6 | 16 | Finland |
| Skills | 8 | 11 | Sweden |
| Creativity | 10 | 16 | Netherlands |
| Mobility | 1 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 3 | 16 | Sweden |
| Patents | 2 | 13 | Finland |
| Bibliometrics | 7 | 9 | Sweden |
| Knowledge flows | 7 | 8 | Finland |
| Total investment in intangibles | 6 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 13 | 10 | Hungary |
| Demand for innovative products | 9 | 16 | Sweden |
| Financing of innovation | 3 | 20 | Denmark |
| Market innovation outputs | 4 | 12 | Malta |
| Organisational indicators | 13 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 16 | 25 | Luxembourg |
| Productivity | 8 | 14 | Luxembourg |
| Employment | 9 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 16 | 6 | Latvia |
| Employment and economic welfare | 1 | 18 | Japan |
| Quality of life indicators | 12 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 10 | 12 | Luxembourg |
| Knowledge production and diffusion | 29 | 8 | Luxembourg |
| Economic structure | 19 | 1 | EU25 |
| Human resources | 9 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 18 | Above the EU25 average |
| 7 | Close to the EU25 average |
| 4 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.037 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | [0.338] | 0.530 | UK |
| Individuals using the internet for banking (% total) | [0.264] | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 498.0 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | 13.5 | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | [0.15] | 0.321 | Sweden |
| Employed in creative occupations (% total) | [0.403] | 0.477 | Netherlands |
| BERD performed in service industries (%) | 2.4E-04 | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 53.5 | 125.6 | Finland |
| Triadic patent families (per million pop.) | 120.1 | 120.1 | Japan |
| Firm entries (birth rate) | [0.103] | 0.163 | Hungary |
| GDP (per capita) | 24700 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | [0.052] | 0.084 | Denmark |
| SMEs reporting non technological change (%) | [0.202] | 0.358 | Slovakia |
| GDP per capita (in PPS) | 108.9 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.027 | 0.087 | Latvia |
| Total employment growth | [0.006] | 0.038 | Cyprus |
| Long term unemployment rate | 0.016 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.083 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 2.084 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | 0.036 | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.095 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | [0.052] | 1.173 | Luxembourg |

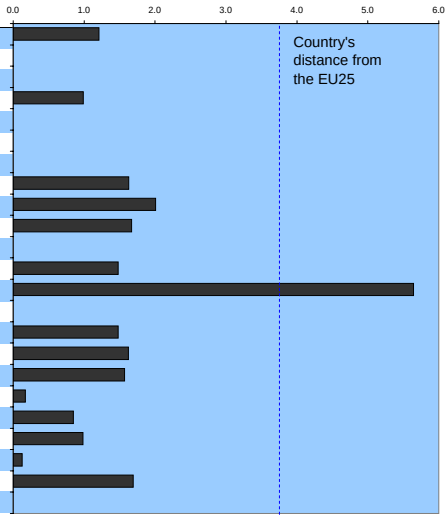
# USA

| | Rank 1 | Rank 2 | Rank 3 | Rank 4 | Rank 5 | Rank 6 | Rank 7 | Rank 8 | Rank 9 | Rank 10 | Rank 11 | Rank 12 | Rank 13 | Rank 14 | Rank 15 | Rank 16 | Rank 17 | Rank 18 | Rank 19 | Rank 20 | Rank 21 | Rank 22 | Rank 23 | Rank 24 | Rank 25 | Rank 26 | Rank 27 | Rank 28 | Rank 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Knowledge Economy Index*** | 11 | 32 | 2 | 4 | 39 | 9 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Production and diffusion of ICT** | 0 | 0 | 11 | 54 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Human resources, skills and creativity** | 0 | 0 | 11 | 32 | 21 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Knowledge production and diffusion** | 0 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Innovation, entrepreneurship, creative production** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 4 | 25 | 14 | 4 | 18 | 7 | 0 | 0 | 4 | 4 | 0 | 4 | 4 | 0 | 0 | 0 |
| **Economic outputs** | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social performance** | 0 | 0 | 0 | 11 | 79 | 7 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Internationalisation** | 0 | 7 | 4 | 4 | 43 | 21 | 7 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Knowledge Economy sub-indices** | country rank | EU25 rank | Best performer (rank 1) |
|---|---|---|---|
| **Production and diffusion of ICT** | | | |
| Economic impact of ICT | 8 | 17 | Finland |
| Internet use by firms | 6 | 14 | UK |
| Internet use by individuals | 6 | 15 | Denmark |
| Government ICT | 4 | 15 | Finland |
| **Human resources, skills and creativity** | | | |
| General education | 6 | 8 | Finland |
| Human resource in S&T education | 9 | 16 | Finland |
| Skills | 7 | 11 | Sweden |
| Creativity | 3 | 16 | Netherlands |
| Mobility | 7 | 20 | Japan |
| **Knowledge production and diffusion** | | | |
| Research and experimental development (R&D) | 4 | 16 | Sweden |
| Patents | 7 | 13 | Finland |
| Bibliometrics | 2 | 9 | Sweden |
| Knowledge flows | 11 | 8 | Finland |
| Total investment in intangibles | 4 | 9 | Malta |
| **Innovation, entrepreneurship and creative production** | | | |
| Entrepreneurship | 23 | 10 | Hungary |
| Demand for innovative products | 8 | 16 | Sweden |
| Financing of innovation | 6 | 20 | Denmark |
| Market innovation outputs | 14 | 12 | Malta |
| Organisational indicators | 26 | 15 | Slovakia |
| **Economic outputs** | | | |
| Income | 2 | 25 | Luxembourg |
| Productivity | 5 | 14 | Luxembourg |
| Employment | 4 | 19 | Cyprus |
| **Social performance** | | | |
| Environmental | 10 | 6 | Latvia |
| Employment and economic welfare | 4 | 18 | Japan |
| Quality of life indicators | 8 | 16 | Belgium |
| **Internationalisation** | | | |
| Trade | 18 | 12 | Luxembourg |
| Knowledge production and diffusion | 10 | 8 | Luxembourg |
| Economic structure | 6 | 1 | EU25 |
| Human resources | 3 | 17 | Luxembourg |

| **Number of KEI sub-indices (total of 29)** | |
|---|---|
| 19 | Above the EU25 average |
| 6 | Close to the EU25 average |
| 4 | Below the EU25 average |

| Key indicators for the Knowledge Economy | Value | Best performer | |
|---|---|---|---|
| ICT value-added (% of total business sector value added) | 0.052 | 0.096 | Finland |
| SMEs ordering over the Internet (% of total SMEs) | [0.402] | 0.530 | UK |
| Individuals using the internet for banking (% total) | [0.206] | 0.500 | Finland |
| Pisa reading literacy of 15y (average score) | 495.0 | 543.0 | Finland |
| Total researchers (per 1000 labour force in FTE) | [11.689] | 22.3 | Finland |
| Participation in lifelong learning (% of working 25-64y) | [0.154] | 0.321 | Sweden |
| Employed in creative occupations (% total) | [0.448] | 0.477 | Netherlands |
| BERD performed in service industries (%) | 1.8E-04 | 2.7E-04 | Sweden |
| EPO high tech patent applications (per million pop.) | 47.6 | 125.6 | Finland |
| Triadic patent families (per million pop.) | 54.1 | 120.1 | Japan |
| Firm entries (birth rate) | [0.085] | 0.163 | Hungary |
| GDP (per capita) | 33600 | 54700 | Luxembourg |
| Early-stage venture capital ( % GDP) | 0.037 | 0.084 | Denmark |
| SMEs reporting non technological change (%) | [0.323] | 0.358 | Slovakia |
| GDP per capita (in PPS) | 147.9 | 240.7 | Luxembourg |
| Real GDP growth rate | 0.039 | 0.087 | Latvia |
| Total employment growth | 0.011 | 0.038 | Cyprus |
| Long term unemployment rate | 0.007 | 0.118 | USA |
| Hampered in daily activities because of chronic conditions | 0.077 | 0.164 | Ireland |
| Rooms per person by tenure status and type of housing | 2.061 | 2.600 | Netherlands |
| Technology balance of payments (% GERD) | 0.077 | 1.646 | Luxembourg |
| Co authorship share on international S&E articles | 0.233 | 0.322 | Luxembourg |
| Foreign PhD students (% total PhD enrolment) | [0.289] | 1.173 | Luxembourg |



# 6. References


Adda J., Chandola T., Marmot M., 2003, Socio-economic status and health: causality and pathways, Journal of Econometrics 112 (1):57-63.

Aitcheson J., 2003, Adult Literacy and Basic Education: A SADC regional perspective, Adult Education and Development 60: 161-171.

Amiel Y., Cowell F.A., 1999, Thinking about Inequality. Cambridge.

Andrews C. J., Hassenzahl D.M., Johnson B.B, 2004, Accommodating uncertainty in comparative risk, Risk Analysis 24 (5):1323-1335.

Atkinson A.B., 1970, On the Measurement of Inequality, Journal of Economic Theory 2:244-263.

Atkinson A.B., 1983, The Economics of Inequality, 2nd edition, Clarendon Press, Oxford.

Bandura R., 2005, Measuring Country Performance and State Behavior: A Survey of Composite Indices, UNDP/ODS Background Paper.

Booysen F., 2002, An overview and evaluation of composite indices of development, Social Indicators Research 59 (2):115-151.

Borda J.C. de, 1784, Mémoire sur les élections au scrutin, in Histoire de l' Académie Royale des Sciences, Paris.

Brand D. A., Saisana M., Rynn L. A., Pennoni F., Lowenfels A. B., 2007, Comparative Analysis of Alcohol Control Policies in 30 Countries, PLoS Medicine 4(4): 752-759.

Canadian Council on Learning, 2006, Falling voter turnout: Is it linked to diminished civics education?, Lessons in Learning series, Jan. 16, 2006, www.ccl-cca.ca

Canadian Council on Learning, 2007a, The 2007 Composite Learning Index: Helping Communities improve their quality of Life, Ottawa, pp1-40.

Canadian Council on Learning, 2007b, State of Learning in Canada: No Time for Complacency, Report on Learning in Canada 2007, Ottawa, www.ccl-cca.ca/solr.

Cartwright F., 2007, Challenges in Communicating Data Quality for Composite Indices, paper presented in abstract form in 2007 Conference of European Survey Research Association, Prague, June 25-29.

Cartwright F., Mussio J., Boughton C., 2006, Developing the Composite Learning Index - A Framework, Canadian Council on Learning. Ottawa.

Cherchye L., Moesen W., Rogge N., van Puyenbroeck T., Saisana M., Saltelli A., Liska R., Tarantola S., 2007, Creating Composite Indicators with Data Envelopment Analysis and Robustness Analysis: the case of the Technology Achievement Index, Journal of the Operational Research Society, online 27 June 2007; doi: 10.1057/palgrave.jors.2602445.

Cherchye L., Moesen W., van Puyenbroeck T., 2004, Legitimately diverse, yet comparable: on synthesising social inclusion performance in the EU. Journal of Common Market Studies 42: 919–955.

Condorcet M. de, 1785, Essai sur l'application de l'analyse à la probabilité des décisions rendues à la probabilité des voix, De l' Imprimerie Royale, Paris.

Cowell F.A., 1980, On the Structure of Additive Inequality Measures, Review of Economic Studies 47:521-31.

Cowell F.A., 1985, Measures of Distributional Change: An Axiomatic Approach, Review of Economic Studies 52:135-51.

Cowell F.A., 1989, Sampling Variance and Decomposable Inequality Measures, Journal of Econometrics, 42:27-41.

Cowell F.A., 1995, Measuring Inequality, 2nd edition, Harvester Wheatsheaf, Hemel Hempstead.

Cowell F.A., 1999, Measurement of Inequality, in Atkinson, A.B. and F. Bourguignon (eds) Handbook of Income Distribution, North Holland, Amsterdam.

Cutter S. L., Boruff B.J., Shirley, W.L, 2003, Social vulnerability to environmental hazards. Social Science Quarterly 84(1):242-261.
Dalton H., 1920, The Measurement of the Inequality of Incomes, Economic Journal 30:348-61.
Dalton R., Klingemann H. D., 2005, A New Handbook of Political Science. Oxford, Oxford University Press.
Darton R. A., 1980, Rotation in Factor Analysis, The Statistician 29(3):167-194.
Delors J., Al Mufti I., Amagi A., Carneiro R., Chung F., et al., 1996, Learning: The Treasure Within – Report to UNESCO of the International Commission on Education for the Twenty-first Century. Paris, UNESCO.
Diener Ed, Suh E., 1997, Measuring quality of life: Economic, social, and subjective indicators. Social Indicators Research 40(1-2):189-216.
Doherty G., 1997, Zero to Six: The Basis for School Readiness, Ottawa, Human Resources Development Canada.
Dorfman R., 1979, A Formula for the Gini Coefficient, The Review of Economics and Statistics 61:146-149.
Dunteman G.H., 1989, Principal components analysis. Thousand Oaks, CA: Sage Publications, Quantitative Applications in the Social Sciences Series, No. 69.
Eakin H., Luers A. L., 2006, Assessing the vulnerability of social-environmental systems. Annual Review of Environment and Resources 31:365-394.
Eyles J., Furgal C., 2002, Indicators in environmental health: identifying and selecting common sets. Canadian Journal of Public Health 93(S1):S62-67.
Gall M, 2007, Indices of social vulnerability to natural hazards: A comparative evaluation, PhD dissertation, Department of Geography, University of South Carolina.
Gastwirth J. L., 1972, The Estimation of the Lorenz Curve and Gini Index, The Review of Economics and Statistics 54:306-316.
Gini C., 1912, Variabilità e mutabilità, Reprinted in Memorie di metodologica statistica (Ed. Pizetti E, Salvemini, T). Rome: Libreria Eredi Virgilio Veschi (1955).
Gini C., 1921, Measurement of Inequality and Incomes, The Economic Journal 31: 124-126.
Hartigan J., Wong M.A., 1979, A k-means Clustering Algorithm. Journal of Applied Statistics 28:100-108.
JRC/OECD, 2005, Handbook on Constructing Composite Indicators: Methodology and User Guide, by Nardo M., Saisana M., Saltelli A., Tarantola S., Hoffman A., Giovannini E., Paris, OECD Statistics Working Paper.
Kaufman L., Rousseeuw P. J., 1990, Finding Groups in Data: An Introduction to Cluster Analysis. Wiley-Interscience.
Keeney R., Raiffa H., 1976, Decision with multiple objectives: preferences and value trade-offs, Wiley, New York.
Kenkel D, 1991, Health behavior, health knowledge, and schooling, Journal of Political Economy 99(2):287–305.
Kim J., Mueller C.W., 1978a, Introduction to factor analysis: what it is and how to do it. Beverly Hills, Sage.
Kim J., Mueller C.W., 1978b, Factor analysis: statistical methods and practical issues. Beverly Hills, Sage.
Krueger A., Lindahl M., 1999, Education for Growth in Sweden and the World, NBER Working Paper no. 7190.
Liepmann D., Stephanopoulos G., 1985, Development and global sensitivity analysis of a closed ecosystem model, Ecological Modelling 30(1-2):13-47.
Litchfield J.A., 1999, Inequality: Methods and Tools, Text for the World Bank PovertyNet website:http://www.worldbank.org/poverty.
Manly B., 1994, Multivariate statistical methods, Chapman & Hall, UK.

Melyn W., Moesen W., 1991, Towards a synthetic indicator of macroeconomic performance: Unequal weighting when limited information is available. Public Economics Research paper 17, CES, KU Leuven.

Moffitt R., 2005, Remarks on the analysis of causal relationships in population research. Demography 42(1):91-108.

Nicoletti G., Scarpetta S., Boyland O., 2000, Summary indicators of product market regulation with extension to employment protection legislation, Economics Department Working Paper no 226, ECO/WKP(99)18.

OECD, 2001, The Well-being of Nations: the role of human and social capital, Paris, Centre for Educational Research and Innovation.

OECD, 2005, Education at a Glance, Paris.

Oreskes N., Shrader-Frechette K., Belitz K., 1994, Verification, Validation, and Confirmation of Numerical Models in the Earth Sciences, Science 263(5147):641–646.

Podinovskii V.V., 1994, Criteria importance theory, Mathematical Social Sciences 27: 237-252.

Saisana M., Tarantola S., 2002, State-of-the-art Report on Current Methodologies and Practices for Composite Indicator Development, EUR Report 20408 EN, European Commission, JRC, IPSC, Ispra, Italy, pp. 72.

Saisana M., Tarantola S., Saltelli A., 2005, Uncertainty and sensitivity techniques as tools for the analysis and validation of composite indicators, Journal of the Royal Statistical Society A, 168(2):307-323.

Saltelli A., Chan K., Scott M., 2000, Sensitivity Analysis. John Wiley & Sons Ltd.

Saltelli A., Ratto M., Anders T., Campolongo F., Carboni J., Gabelli D., Saisana M., Tarantola S., 2007, Global sensitivity analysis. Gauging the worth of scientific models, John Wiley & Sons, England.

Stevens J., 1986, Applied multivariate Statistics for the social sciences. Hillsdale, NJ - Lawrence Erlbaum Associates.

Thanassoulis E., Portela M.C., Allen R., 2004, Incorporating value judgments in DEA, in W.W. Cooper, L.M. Seiford and J. Zhu (eds.), Handbook on Data Envelopment Analysis, Kluwer Academic Publishers, Boston.

Tryon R. C., 1939, Cluster Analysis. Edwards Brothers.

UNCTD, 2005, Trade and Development Index, Developing countries in international trade, United Nations Conference on Trade and Development.

Vansnick J. C., 1990, Measurement theory and decision aid - in Bana e Costa C.A. (ed.) - Readings in multiple criteria decision aid, Springer-Verlag, Berlin, pp. 81-100.

von Schirnding Y., 2002, Health in sustainable development planning: the role of indicators, WHO/HDE/HID/02.11. Geneva: World Health Organization (WHO).

Wolfe B., Haveman R., 2001, Accounting for the Social and Non-market Benefits of Education, The contribution of Human and Social Capital to Sustained Economic Growth and Well-being: International Symposium Report, J.F. Helliwell, ed., Ottawa and Paris, Human Resources Development Canada and OECD.

Wong Y-H B, Beasley J.E., 1990, Restricting weight flexibility in data envelopment analysis, Journal of the Operational Research Society 47:136-150.

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**Abstract**

In the Knowledge-based Economy conceptual framework that was developed by MERIT a total of 115 individual indicators have been selected to measure the sub-dimensions of the KBE. The high number of individual indicators raises the issue of robustness of the ranking obtained by their aggregation into one composite measure. To tackle this issue a sensitivity analysis is a fundamental step of the KEI composite indicator. In particular, in building the KEI composite an innovative methodological assumption has been made, i.e. it is considered as the final composite index the frequency of all rankings obtained by means of all the simulations carried out. This allows us to deal with the criticism, often made to composite indicators that rankings are presented as they were under conditions of certainty while it is well known that this is not true in general terms. Most practitioners compute a composite indicator by a simple weighted summation mathematical model. Sometimes it is acknowledged that the ranking obtained is subject to some uncertainty, but this issue is treated as a kind of mathematical appendix for technical readers, and all policy suggestions are derived under the assumption of the linear aggregation model. Here the ranking presented is the one derived by considering the whole spectrum of uncertainty. It is important to note that this is a peculiar characteristic of the KEI composite.

The scenarios, simulations and indicators developed by the JRC team answer five main research questions:
1. Is it possible to measure the knowledge economy?
2. What are the drivers of the knowledge economy?
3. How does knowledge economy relate to other complex dimensions?
4. Is it possible to reduce the total number of individual indicators of KEI conceptual framework without loosing any relevant information?
5. Are rankings useful at all for deriving policy suggestions?.

The mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.

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