# National Competitiveness and Productivity Council
# Bulletin 23-2 International Innovation Indicators

- **Ireland's ranking in the Global Innovation Index stood at 23rd in 2022, with a significantly stronger performance under innovation outputs (19th) compared to innovation inputs (25th). Ireland's ranking has deteriorated in recent years. Ireland last reached the top 10 in 2018.**
- **While Ireland was regarded as a 'Strong Innovator' in the European Innovation Scoreboard 2023, our lead over lower ranking countries is shrinking, while the higher ranking "Innovation Leaders" are increasing their lead.**
- **Dublin ranks 18th in the European Digital Social Innovation Index, with a strong performance under 'Skills'.**
- **Composite indices of innovation are valuable tools to assess and benchmark Ireland's performance versus international competitors; however, these indices should be interpreted with caution and must be understood in the broader macroeconomic and policy context. The use of GDP to denominate or scale indicator values risks misrepresenting Ireland's performance.**

## OVERVIEW

Innovation is a fundamental driver of economic progress and an important determinant of international competitiveness. Through innovation, firms can improve their performance and introduce new processes, products, and services, delivering value and securing advantages over competitors.[1] Investment in research and development (R&D) is essential for Irish enterprises to innovate, allowing them to compete and thrive in competitive domestic and international markets. The economic impact of R&D activities depends on the scale and quality of the firm's investment, the interaction of firms, universities, and Government, as well as education and training systems, the labour market, and the financial system.[2]

As highlighted in the National Competitiveness and Productivity Council's (NCPC's) *Ireland's Competitiveness Challenge 2022*,[3] innovation can play an important role in boosting productivity growth, particularly as we work towards the green and digital transitions. The paths to climate neutrality and successful digital transformation provide new avenues for productivity growth, and research, development and innovation will be key to meeting these challenges. It is important, therefore, that the NCPC continues to monitor and assess Ireland's innovation performance relative to international competitors. In recognition of the important role that innovation plays in boosting productivity, the 2022 Challenge report included two explicit recommendations regarding innovation in Ireland.[4]

This Bulletin examines the various tools used by the NCPC to benchmark innovation in Ireland, focusing on three indices measuring innovation: the Global Innovation Index, the European Innovation Scoreboard, and the European Digital Social Innovation Index. This Bulletin follows the publication of *Ireland's Competitiveness Scorecard 2023*[5] (May 2023) and will inform the NCPC's considerations as part of the forthcoming *Ireland's Competitiveness Challenge 2023* report. This Bulletin is also intended as a companion piece to Bulletin 22-5 – International Competitiveness Indicators.[6]

## GLOBAL INNOVATION INDEX (GII)

Launched in 2007,[7] the Global Innovation Index (GII) aims to provide a statistical benchmark for measuring innovation and for comparing national innovation ecosystems, particularly among countries that have

[1] Damanpour, F. 1991. "Organisational Innovation: A Meta-Analysis of Effects and Determinants and Moderators", *The Academy of Management Journal*, Vol. 34, No. 3.
[2] Lewandowska, A. and I. Švihlíková. 2020. "Regional Innovation System in the podkarpackie against selected Polish and EU regions, *Journal of International Studies*, 13(2), 212-22.
[3] Ireland's Competitiveness Challenge 2022, National Competitiveness and Productivity Council, September 2022.
[4] *Ibid*. See Recommendation 2.3: 'The NCPC recommends that in order to secure Ireland's position as a strong innovator, the Government should ensure that: (i) the Impact 2030 strategy is implemented without delay and progress on targets is monitored on an annual basis; (ii) the Research Bill is passed without delay and that the new research and innovation funding agency is established with some urgency to drive and fund research, particularly interdisciplinary research'; and Recommendation 4.1: 'The NCPC recommends: (i) Continued focus on monitoring and resourcing of, initiatives such as the new Construction Technology Centre, the MMC Demonstration Park and the Build Digital project, to increase innovation that will contribute to productivity and quality improvements in the construction sector; (ii) Ensuring the upskilling of construction workers with the skills relating to Modern Methods of Construction to enable the sector to meet its targets as set out under HFA, NDP and CAP; and that this sectoral upskilling is monitored.'
[5] Ireland's Competitiveness Scorecard 2023, National Competitiveness and Productivity Council, May 2023.
[6] Bulletin 22-5: International Competitiveness Indicators, NCPC, 22 December 2022.
[7] The Global Innovation Index was launched by INSEAD.

similar income levels. The GII provides an innovation ranking for approximately 130 world economies.

Since 2021, the GII has been published by a specialist agency of the United Nations – the World Intellectual Property Organisation (WIPO) – in partnership with the Portulans Institute (a nonpartisan research body based in Washington DC), corporate and academic partners, and the GII Advisory Board. The GII is comprised of:

- An Innovation Input Sub-Index with **five input pillars** that capture aspects of the economy that facilitate innovative activities (e.g. institutions – the political and regulatory environment; infrastructure, etc.);
- An Innovation Output Sub-Index with **two output pillars** that capture the result of innovative activities in the economy (e.g. knowledge creation, impact and diffusion; and intangible assets);
- An overall GII score that is the average of the input and output sub-indices (the Output Sub-Index carries the same weight as the Input Sub-Index in calculating the overall score).

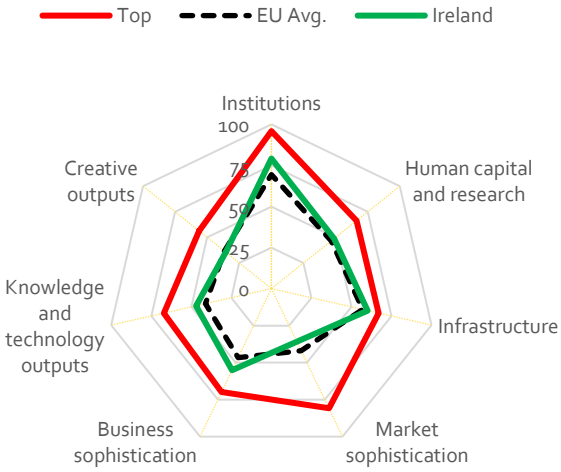
The 2022 index includes 81 indicators, which fall into three categories: quantitative/objective/hard data (65 indicators); composite indicators/index data (13 indicators); and survey/qualitative/subjective/soft data (3 indicators).

Weights of 0.5 or 1 are assigned as scaling coefficients (rather than importance coefficients) to determine pillar and sub-pillar scores that are balanced in their underlying components (e.g. so that indicators can explain a similar amount of variance in their respective sub-pillars). Half-weights were assigned to eight indicators, namely: Regulatory Quality Index, Rule of Law Index, Researchers (FTE per million population), Gross Expenditure on R&D (as a % of GDP),[†] ICT Access Index,[†] ICT Use Index,[†] Government Online Service Index,[†] and e-Participation Index.

In 2022, Ireland ranked 23rd overall (15th among 39 European economies), with a significantly stronger performance under innovation outputs (19th) compared to inputs (25th). This suggests that the outputs from innovation activity in Ireland are beyond what might be expected, given the state of enabling factors in the broader macroeconomic and policy environment.[8]

For each of the seven GII pillars, Figure 1 benchmarks Ireland's score against the EU average score and the top score. Ireland outperforms the EU average in five of the seven pillars but underperforms in Market Sophistication and Creative Outputs (albeit marginally). Ireland is furthest from the top performing country in Market Sophistication (with a score of 36 versus 81 – the US), and closest in Infrastructure (60 versus 67 – Sweden).

**Figure 1.** Ireland's score across the seven GII pillars, versus EU average and top-ranked economy




**Source:** NCPC based on Global Innovation Index Database, WIPO, 2022.
**Notes.** 'Top' refers to the score of the top performing country under each pillar, while 'EU Avg.' refers to the average score among EU member states.

Compared internationally, Ireland generally ranks ahead of the EU average, but falls considerably far behind leading countries, such as the US, the UK, and Japan. Ireland's overall innovation ranking has deteriorated consistently in the last several years. The fall in Ireland's overall innovation ranking has been driven by a deterioration in performance across several indicators. Focusing first on the short-term dynamics, Ireland's annual ranking has fallen consistently since 2020 across a number of key indicators.

Under the **Human Capital and Research** pillar, Ireland's performance has deteriorated in: expenditure on education (as a percentage of GDP, down 30 places on 2020) and gross expenditure on R&D (as a percentage of GDP, down 19 places on 2020). Under **Infrastructure**, Ireland's ranking for ICT access has fallen 39 places below the 2020 ranking. Ireland's ranking for domestic credit to the private sector (under **Market Sophistication**), has also fallen consistently since 2020, and as of 2022, was 46 places below the 2020 ranking. Similarly, under **Business**

[†] These indicators are considered weaknesses for Ireland.

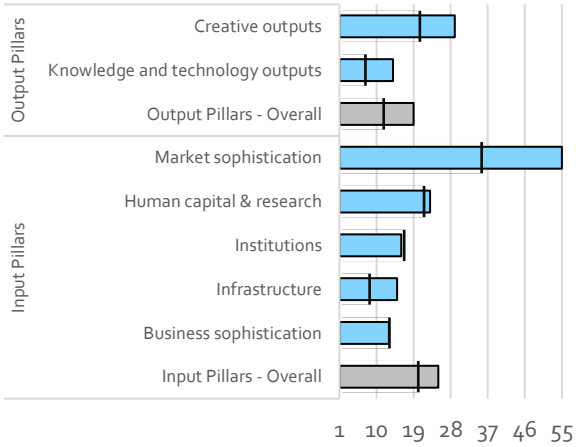
[8] The link between innovation inputs and outputs (as measured in the GII) has been well established in the academic literature. For example, see: Araujo Reis, D., De Moura, F. R. and I. M. De Aragao. 2021. "The Linkage between Input and Output in the Innovation Ecosystem", *Global Journal of Human-Social Science*, Vol. 21, Issue 3.

**Sophistication**, Ireland's ranking for high-tech imports was 59 places below the 2020 ranking.

Ireland's ranking for labour productivity (under **Knowledge and Technology**), has fallen dramatically since 2020, and as of 2022, was 79 places below the 2020 position. Finally, under **Creative Outputs**, Ireland's ranking for industrial designs by origin held constant over 2020-2021 but fell 30 places in 2022. While gross capital formation (under Infrastructure) improved in 2021 (to 18th place) it fell significantly in 2022, by 59 places.

To provide a medium-term view, Figure 2 shows Ireland's 2022 ranking under each of the seven pillars versus our five-year average ranking over 2017-2021.[9]

**Figure 2.** Ireland's ranking across the seven GII pillars




**Source:** NCPC based on Global Innovation Index Database, WIPO, 2022.
**Notes.** Vertical lines correspond to the average ranking over 2017-2021.

As shown, there was a deterioration in 2022 relative to the preceding five-year average, across most pillars, but particularly for Market Sophistication (Ireland placed 55th in 2022 versus a five-year average of 35th). Infrastructure, which has been volatile, fell significantly in 2022 and is well below its five-year average position. While Business Sophistication, and Human Capital and Research, both improved in 2022 relative to 2021 (not shown), Figure 2 shows that they remain at or below their five-year average positions.

Of all seven pillars, the weakest performance for Ireland in 2022 was under Market Sophistication. At the indicator level, Ireland scores particularly poorly in:

- Domestic credit to the private sector (as a percentage of GDP);[10]
- Domestic industry diversification;[11] and,
- Market capitalisation (as a percentage of GDP).

In contrast, Ireland's strongest performance was under Business Sophistication, with strong scores in terms of:

- Females employed with advanced degrees;
- University-industry R&D collaboration; and,
- Intellectual property payments (as a percentage of total trade).[12]

While the GII is useful as a guide in benchmarking Ireland's performance across key areas of competitiveness, there are several caveats that must be noted when interpreting these results.

There are well documented limitations to using GDP as a means of measuring economic activity in the Irish context, given the scale of globalisation-related activities. In general, any ratio that relies on GDP as the denominator will give a distorted view of Ireland's performance. Of the 81 indicators included in the GII, 29 are measured or scaled in terms of GDP. Of these, 26 will likely understate Ireland's actual performance.[13] This results in an overall poorer result for Ireland in the GII than if an alternative measure was used that better accounts for the size of the domestic economy, namely, Modified Gross National Income (GNI*).[14]

As an example, focusing on just one of these indicators, if R&D expenditure is rescaled using GNI*, rather than GDP, Ireland's ranking under the Human Capital and Research pillar increases by one place, from 23rd to 22nd, displacing Portugal.[15] This in turn improves Ireland's overall GII score, though in terms of ranking, we remain (now very marginally) behind Norway.

[9] It is important to note that methodological changes can occur year-on-year, meaning that some degree of caution is warranted when interpreting annual changes in performance across the indices assessed in this Bulletin.

[10] This tracks the financial resources provided by financial corporations, including monetary authorities and money deposit banks, and where data is available, finance and leasing companies, money lenders, insurance corporations, pension funds and foreign exchange companies. This data does not include loan schemes provided to enterprise by the State, for example, in the Irish context, the Microenterprise Loan Fund Scheme and the COVID-19 Loan Scheme.

[11] This refers specifically to manufacturing output and is based on the Herfindahl-Hirschman Index (HHI), which is calculated as the sum of the squared shares of sub-sectors in total manufacturing output. The HHI is a measure of concentration and can help to determine the extent to which a country's industrial system is diversified across different industrial sub-sectors.

[12] This is unsurprising, given the significant onshoring of multinational intellectual property assets that has taken place in Ireland, most prominently since 2015.

[13] A further three may overstate Ireland's performance.

[14] See: National Accounts Explained – Modified GNI, CSO.

[15] This approach is also more consistent with national targets. For example, the Government's research and innovation strategy, *Impact 2030*, sets a target for gross expenditure on R&D of 2.5% of GNI* (rather than GDP) by 2030.

There are other limitations. Some indicators rely on data that are outdated for Ireland – for example, data on education spending in the GII relates to 2018, while the data used to assess domestic industry diversification is from 2014. In other cases, relevant data are missing for Ireland, including the pupil-teacher ratio at second level and loans from microfinance institutions (including relevant Government loan schemes). While gross expenditure on R&D as a percentage of GDP is regarded as a weakness for Ireland, apart from the issues associated with the use of GDP (discussed previously), this indicator captures direct expenditure only and does not reflect additional supports provided *via* the tax system (i.e., tax expenditures such as the R&D tax credit).[16] Consequently, the methodology used here will also understate Ireland's actual performance.

Finally, while the GII includes a large number of individual indicators that cover a broad range of competitiveness issues, some pillars are limited in focus. For example, the Infrastructure pillar includes only three sub-pillars: Information and Communication Technologies; General Infrastructure; and Ecological Sustainability. Of these, General Infrastructure tracks performance in terms of: electricity output, logistics, and gross capital formation. The latter is a flow variable capturing changes in the capital stock, rather than the level of the existing capital stock (e.g. in respect of housing, transport and health infrastructure).[17]

In Ireland, gross capital formation also includes highly valuable intangible assets (e.g. intellectual property assets such as patents). In this way, it does not reliably capture the quality of existing infrastructure across the range of dimensions that matter from a competitiveness perspective.

Taken together, these factors need to be reviewed carefully to understand how well they capture Ireland's true performance.

## EUROPEAN INNOVATION SCOREBOARD (EIS)

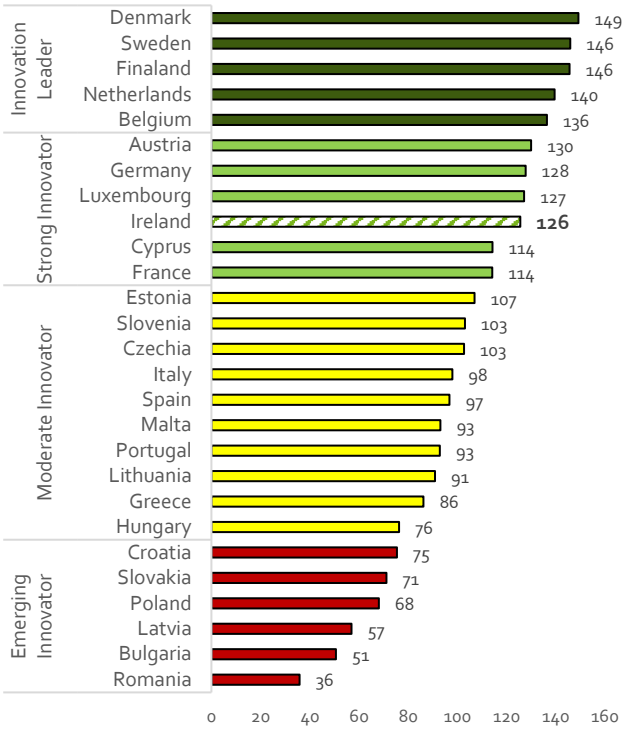
Published by the European Commission, the European Innovation Scoreboard (EIS) compares the innovation performance of EU member states, as well as other European countries and regional neighbours.

EU countries are assigned to one of four performance groups based on their scores. These are: (i) Innovation Leaders; (ii) Strong Innovators; (iii) Moderate Innovators; and (iv) Emerging Innovators. In this way, the EIS is designed to assist countries in assessing the relative strengths and weaknesses of innovation systems, and to identify difficulties and challenges that they need to address in order to strengthen the performance of these systems.

The framework used by the EIS identifies four aspects of innovation systems: Framework Conditions; Investments; Innovation Activities; and Impacts. These are all given equal weight. Within each, the EIS identifies three dimensions of innovation. This results in 12 dimensions of innovation comprising 32 individual indicators.

Figure 3 shows the overall results of the EIS for EU countries in 2023. Denmark is the best performer overall, while other "Innovation Leaders" include Sweden, Finland, the Netherlands, and Belgium. Ireland is categorised as a "Strong Innovator" alongside Austria, Germany, Luxembourg, Cyprus, and France. The countries of central, eastern, and southern Europe make up the "Moderate Innovators" and "Emerging Innovators" categories.[18]

**Figure 3.** EIS – Summary Innovation Index, 2023 Snapshot

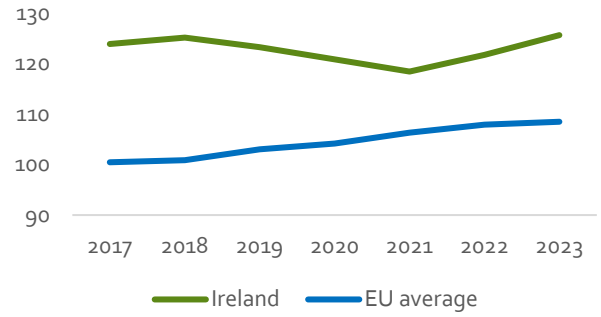



**Source:** NCPC based on European Innovation Scoreboard 2023, European Commission, 2023

[16] See: Research and Development Tax Credit, Revenue Commissioners.
[17] See: Capital Formation and Fixed Assets, CSO.
[18] The EIS also assesses the EU's performance relative to non-EU economies. Between 2016 and 2023, the EU's innovation performance has grown at a faster rate than that of five global competitors (Australia, India, Japan, Mexico, and South Africa) and at a slower rate than that of six global competitors (Brazil, Canada, Chile, China, South Korea, and the US). South Korea scored best overall in the EIS in 2023.

EIS data for 2023 shows that, while Ireland was ranked in the "Strong Innovators" cohort, Ireland's lead over lower ranking countries is shrinking over time. The EIS also indicates that, while those ranked behind Ireland are closing the gap, those in the strongest cohort of "Innovation Leaders" are increasing their lead.[19] This can be gleaned from Figure 4, which shows Ireland's composite (or Summary Innovation Index) score since 2017. Ireland's score has been consistently above the EU average, however, the gap narrowed considerably over 2018-2021. While Ireland's score has improved year-on-year since 2021, with a particularly sharp uptick in 2023, the gap versus the EU average remains smaller than it was over 2017-2019.[20]

**Figure 4.** Summary Innovation Index Score, Ireland vs. EU average, 2017-23




**Source:** NCPC based on European Innovation Scoreboard 2023, Director General for Research and Innovation, European Commission, 2023.

Figure 5 focuses on the four individual elements of innovation systems assessed by the EIS, and shows the ratio of Ireland's score to the EU average. Where a value exceeds one, Ireland outperforms the EU average, and *vice versa*.

We begin by focusing on areas in which Ireland outperforms. As shown, under **Framework Conditions**, Ireland outperforms the EU average on each component in every year from 2017-2023, despite a notable fall in relative performance under digitalisation since 2021.

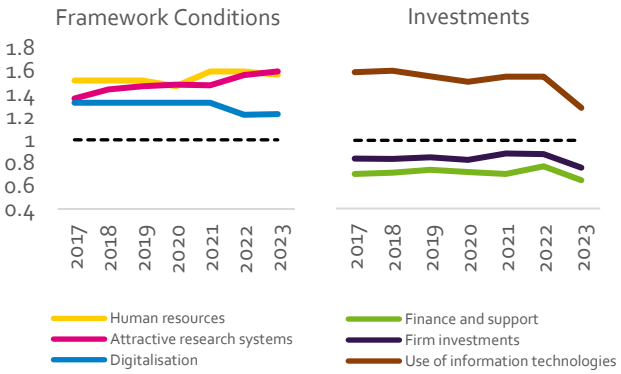
Ireland also performs well under '**Investments** – use of information technologies', albeit, with a sharp drop in relative performance in 2023. Ireland's relative performance under '**Innovation Activities** – linkages' has increased considerably since 2020. Ireland has also improved under 'innovators' for 2023, placing above the EU average for the first time since 2020, a reversal of the persistent downward trend observed over the last number of years. Other relative strengths for Ireland relate to '**Impacts** – employment impacts' and 'sales impacts'. While Ireland has consistently underperformed relative to the EU average in 'environmental sustainability' **(Impacts)**, Ireland's score exceeded the EU average in 2023, albeit very marginally.

Another dimension of **Investments** in which Ireland outperforms EU peers, is in direct government funding and tax support for business R&D. This indicator is captured under '**Investments –** finance and support'. The inclusion of tax supports (as opposed to strictly direct funding) gives a more complete view of the level of state support for R&D activity. Ireland performs strongly on this indicator (at 114.8% of the EU average).

Focusing now on areas where Ireland underperforms, there are three dimensions in which Ireland performs below the EU average as of 2023:

- '**Investments – finance and support':** R&D expenditures in the public sector (i.e. universities and government research organisations) as a percentage of GDP; and venture capital expenditures[21] (specifically, private equity raised for investment in companies) as a percentage of GDP; and,
- '**Investments – firm investments':** R&D expenditure in the business sector as a percentage of GDP; and non-R&D innovation expenditures as a percentage of total turnover.
- '**Innovation Activities –** intellectual assets': PCT patent applications; trademark applications; and design applications (all per billion of GDP).

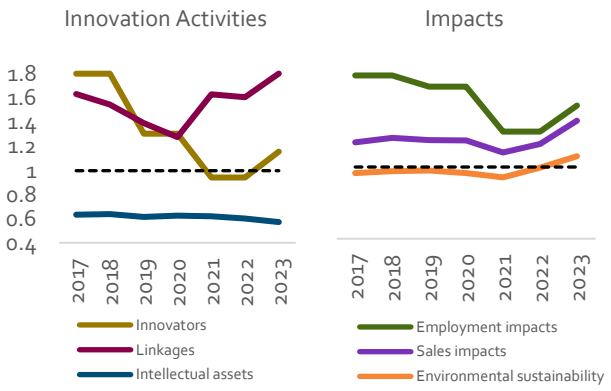
**Figure 5.** EIS, Ratio of Ireland to EU average, 2017-23




[19] See: European Innovation Scoreboard 2023 – Ireland.

[20] Among comparator peer economies, Switzerland, another small and open economy, was ranked 1st among European economies in 2023, and has held this position for several years. Ireland has placed ahead of the UK since 2022, and has remained significantly above Iceland and Portugal.

[21] This is based on the EIS assessment of data provided by Invest Europe.

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**Source:** NCPC based on European Innovation Scoreboard 2023, European Commission, 2023. **Notes.** Dashed line shows parity with the EU average

Ireland's persistent relative weakness in these areas' marks a concerning trend. Spending on R&D is key to creating new knowledge within firms, improving production technologies, and driving productivity growth, and in this way, is also a contributor to economic growth more broadly. Trends in R&D spending are an important indicator of not only current, but also future competitiveness. Venture capital, raised in the form of private equity, is an important source of investment funding for early-stage firms, particularly for those involved in the use or development of innovative new technologies. Non-R&D innovation expenditure includes investment in equipment, and the acquisition of patents, capturing the diffusion of new production technology and ideas. Regarding Ireland's performance under 'intellectual assets', these indicators are intended to capture the outputs of the innovation process, with a focus on intangible assets. They are chosen by the EIS to reflect firms' abilities to develop innovative products and maintain a competitive advantage.

However, as with the limitations outlined previously in respect of the GII, the measurement of R&D and venture capital spending as a proportion of GDP, and 'intellectual assets' per billion of GDP, misrepresents the scale of this activity in Ireland relative to international peers (given the measurement issues associated with GDP in the Irish context).

Finally, the EIS identifies several structural differences between Ireland and the rest of the EU, impacting on Ireland's relative innovation performance. Business services account for a larger proportion of the economy, with large enterprises accounting for a larger share of turnover. Entrepreneurial activity, FDI net inflows, and the activity of top R&D spenders, all contribute positively to an innovation climate, while a relatively low enterprise birth rate acts as a negative contributor.[22] These factors point to the significant contribution of large foreign owned multinationals in Ireland, and a reliance on the activities of the multinational sector.

Governance and policy framework indicators for Ireland are assessed to be close to the EU average. On climate-related indicators, Ireland has a lower share of material resources coming from recycled waste and a below average score on environmental innovation.

## DIGITAL SOCIAL INNOVATION

The European Digital Social Innovation Index (EDSII) is produced by Nesta (the National Endowment for Science, Technology and the Arts)[23] as part of the DSI4EU – an EU-funded project.[24] The EDSII assesses the performance of different urban 'ecosystems' across the EU, in terms of their support for the creation, growth and sustainability of Digital Social Innovation (DSI) initiatives.

In assessing the capacity to support DSI activity, the EDSII examines capacity in a broad sense, beyond government level policy levers. This involves the analysis of political, economic, social, cultural, and technological factors.
The EDSII is intended to help stakeholders, such as policy-makers, in benchmarking cities and in understanding how to better support DSI initiatives. More specifically, five distinct goals are identified:

1. Identify success factors for the creation, growth and sustainability of DSI;
2. Help policymakers understand how they can better support DSI, drawing upon successful examples from other places;
3. Incentivise the development and implementation of supportive policies;
4. Inform practitioners about where in Europe has the best conditions for supporting DSI, which may be influence where practitioners decide to set up or grow their initiatives; and,
5. Raise awareness about, and interest in, DSI among people, communities and organisations not currently involved in the field.

[22] However, it is worth noting that Ireland has the highest survival rate for newly born enterprises in the EU. Source: Eurostat, Business Demography.
[23] See: A brief history of Nesta | Nesta.
[24] The DSI4EU aims to: 'support policy makers, funders and practitioners to grow and scale digital social innovation (DSI) in Europe and to harness the power of people and technology to tackle some of Europe's biggest social and environmental challenges.' DSI4EU also aims to: 'better understand the systemic and macro-level conditions which support the creation, growth and sustainability of DSI initiatives, and to analyse geographically how different parts of the European Union are positioned to support DSI initiatives.' See: Digital Social Innovation for Europe | DSI4EU | Project | Fact sheet | H2020 | CORDIS | European Commission (europa.eu)

In pursuit of these goals, the index tracks the performance of 60 EU cities – including 26 capital cities[25] and 34 additional cities selected based: on the size of the population, DSI activity, availability of data, and to ensure geographical representation.

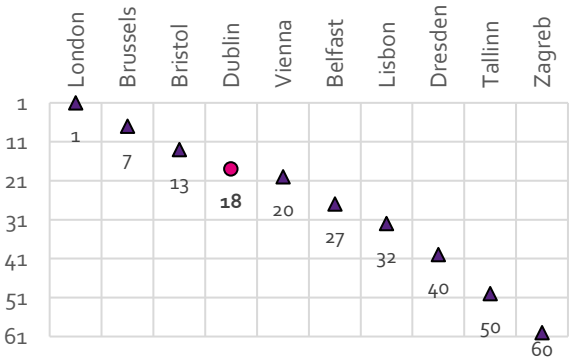
The EDSII comprises 32 indicators grouped into six themes: Civil Society, Collaboration, Diversity and Inclusion, Availability of Funding, Infrastructure and Skills. An overall score is assigned, as well as individual scores for each of the individual themes.

The EDSII is distinct from other indices of innovation, in that the primary focus is on individual cities, rather than countries (as per the GII and the EIS) or regions (as per the EIS). This recognises that DSI activity is particularly active in urban environments, with a critical mass of people, assets, infrastructure, and knowledge. In terms of results, London ranks in first place in the EDSII, with a strong performance across all six themes – placing in the top ten in five themes.

The top five is rounded out by four other capital cities: Amsterdam, Copenhagen, Stockholm and Paris. Northern and Western Europe dominate the top half of the EDSII rankings (28 out of 30 places). Dublin is ranked 18th overall (the tenth best performing capital city), placing ahead of Manchester and behind Berlin.

Figure 6 shows the performance of Dublin alongside a sample of nine other cities.

**Figure 6.** EDSII ranking, selection of cities




**Source:** NCPC based on European Digital Social innovation Index (EDSII)

Dublin's ranking, when compared with the 59 other cities, varies widely across the six individual themes:

- Skills: 5th
- Civil Society: 13th
- Infrastructure: 32nd
- Collaboration: 32nd
- Funding: 30th
- Diversity and Inclusion:51st

Dublin's high performance under '**Skills'** is driven by a particularly strong performance in terms of numbers of employees with data, software engineering and digital skills. This reflects a relatively high number of computer programmers and data scientists based within the city. Dublin also performs well under Civil Society, driven by relatively good scores for participation in volunteering activities and charitable donations.

Dublin's weakest performance is under '**Diversity and Inclusion'**. This result is driven largely by a relatively poor performance in terms of inclusivity of innovation – measured by the percentage of survey respondents that have participated in a course or activity relating to entrepreneurship at school, and by digital inclusion – a measure of the level of basic digital skills across sections of the population. (at the country level).

Dublin performs in the bottom half on each of the other three themes. Focusing on '**Infrastructure'**, average mobile upload and download speeds are slower in Dublin than in other cities. Dublin also underperforms under '**Funding'**, there is a lower proportion of money spent on contractors by local or regional authorities that is going to SMEs, than what is reported elsewhere. In terms of '**Collaboration**', Dublin performs poorly in online collaboration (proxied by the number of GitHub[26] users based within the city with projects containing DSI related keywords in their descriptions), and collaboration between the technology sector and civil society (based on responses to a survey question).

Unlike many other European capital cities, Dublin City Council has few revenue-raising powers and is dependent on funding from central government. As a result, many initiatives that would support DSI activity are a function of central Government Departments which may serve to reduce Dublin's score under the theme of 'Funding'.

## CONCLUSION

This Bulletin attempts to explain the concept of innovation and to better understand the various indices used by the NCPC in assessing Ireland's innovation performance, and to set these indices in a broader context.

[25] Valletta (Malta) and Luxembourg City were excluded because of insufficient data.

[26] It should be noted that alternative platforms may be used more prevalently in different cities which may bias this result.

When measuring and benchmarking innovation in Ireland, the NCPC has to rely on composite indicators. These indices are necessarily simplified or stylised versions of reality – an attempt to communicate complex information in an accessible and effective way to policy-makers and other stakeholders. The choice of variables to include when constructing an index, and the weights to apply to each, are somewhat subjective. However, the inclusion of inappropriate variables, the reliance on outdated information, or the omission of variables due to a lack of information or a difficulty in measurement, can result in an overly simplistic or inaccurate message that is of limited use to stakeholders. For this reason, these indices need to be used with caution.

As highlighted in the academic literature,[27] objective measures of innovation are generally split between input and output indicators – input indicators can evaluate how innovation activities have been conducted or arranged (e.g. R&D intensity, spending), but do not show if something has been achieved or if this activity has yielded outputs. Patents and licenses are commonly used output indicators used to evaluate the effect of innovation activities. However, a key limitation to these metrics, is that they show only successful efforts. Among the issues with more subjective/qualitative indicators (e.g. data collected through surveys), is that they are often based on few respondents, too narrowly focused, and can tend to highlight the presence of a factor or an activity, without necessarily assessing quality or effectiveness.

In addition, while composite indices often include a significant volume of individual indicators, certain themes or categories are more limited in focus, with constraints on the availability of timely and complete information.

There are additional complications when interpreting indicators of innovation in the Irish context. There are well documented limitations to using GDP as a means of measuring economic activity in Ireland, given the scale of globalisation-related activities and their distortionary effect on national statistics. Ireland's performance across some indicators may be considerably better, or worse, if GNI* could be used instead. Later this year, the NCPC intends to publish an assessment of Ireland's performance in the GII using GNI*.

Composite indices of innovation are valuable tools to assess and benchmark Ireland's performance versus international competitors; however, as noted above, these indices should be interpreted with caution and must be understood in the broader macroeconomic and policy context.

While innovation indices provide an opportunity to better understand and to compare national innovation systems, they should be carefully contextualised within the structures and complexity of individual economies. As explored in the international literature,[28] there is not a 'one size fits all' recipe to fostering innovation, but a requirement to tailor to the complexity of conditions within an innovation system. Public funding for R&D activity is a necessary, but on its own cannot be a sufficient condition to drive innovation activity and performance.

**Further Reading:**

The NCPC reports to the Taoiseach and the Government, through the Minister for Enterprise, Trade and Employment, on the key competitiveness and productivity issues facing the Irish economy and makes recommendations to Government on how best to address these issues. The latest NCPC publications can be found at: www.competitiveness.ie.

This Bulletin has been issued by the Chair, Dr. Frances Ruane, and was prepared by: Dr. Dermot Coates and Dr. Keith Fitzgerald in the NCPC Secretariat.

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